



PREFEITURA
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PREFEITURA MUNICIPAL DE ARACRUZ
ESTADO DO ESPÍRITO SANTO
SECRETARIA MUNICIPAL DE SAÚDE

DOCUMENTO DE FORMALIZAÇÃO DA DEMANDA – DFD

SETOR REQUISITANTE (SETOR/DEPTO):	SECRETARIA:
Gerência do Complexo de Saúde de Aracruz	SEMSA
RESPONSÁVEL PELA DEMANDA:	CARGO:
ANDREIA SILVA DE LIMA	Gerente

1. Objeto da Contratação:

1.1 A Secretaria Municipal de Saúde reconhece a importância e a necessidade da realização de manutenção preventiva e corretiva no grupo gerador instalado no Complexo de Saúde de Aracruz – CSA.

2. Justificativa da necessidade da contratação:

2.1 A presente contratação mostra-se necessária diante da imprescindibilidade de garantir o pleno funcionamento do grupo gerador instalado no Complexo de Saúde de Aracruz – CSA, equipamento essencial para assegurar a continuidade do fornecimento de energia elétrica em situações de interrupção da rede convencional.

2.2 Considerando que o CSA abriga serviços de saúde essenciais e ininterruptos, a indisponibilidade do grupo gerador pode acarretar graves prejuízos à assistência prestada à população, colocando em risco a segurança de pacientes, servidores e a integridade de equipamentos médico-hospitalares sensíveis.

2.3 A manutenção preventiva e corretiva do grupo gerador é medida indispensável para assegurar sua confiabilidade, desempenho adequado e prolongamento da vida útil do equipamento, além de reduzir riscos de falhas inesperadas, custos elevados com reparos emergenciais e paralisações não programadas.

2.4 Ressalte-se, ainda, que a Administração Pública não dispõe de equipe técnica especializada nem de ferramentas adequadas para a execução desse tipo de serviço, tornando necessária a contratação de empresa especializada, em observância aos princípios da eficiência, continuidade do serviço público, segurança operacional e economicidade.

2.5 Dessa forma, a contratação pretendida atende ao interesse público, sendo fundamental para a manutenção da infraestrutura crítica do Complexo de Saúde de Aracruz e para a garantia da regularidade e qualidade dos serviços de saúde prestados à população.

2.6. Objetivos da Contratação:

2.6.1 A presente contratação tem por objetivo assegurar a adequada manutenção preventiva e corretiva do grupo gerador instalado no Complexo de Saúde de Aracruz – CSA, de modo a garantir a continuidade, a segurança e a confiabilidade do fornecimento de energia elétrica às unidades e



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serviços de saúde ali instalados.

2.6.2 Constituem objetivos específicos da contratação:

- I – Garantir o pleno funcionamento e a disponibilidade operacional do grupo gerador, prevenindo falhas e interrupções inesperadas no fornecimento de energia elétrica;
- II – Assegurar a continuidade dos serviços públicos de saúde, especialmente daqueles que dependem de energia elétrica ininterrupta para a preservação da vida, da segurança dos pacientes e do correto funcionamento de equipamentos médico-hospitalares;
- III – Realizar manutenções preventivas periódicas, com vistas à identificação antecipada de desgastes, ajustes necessários e eventuais não conformidades;
- IV – Executar manutenções corretivas sempre que necessário, de forma célere e eficiente, minimizando riscos operacionais e tempo de indisponibilidade do equipamento;
- V – Prolongar a vida útil do grupo gerador, contribuindo para a redução de custos decorrentes de falhas graves, substituições prematuras ou contratações emergenciais;
- VI – Garantir que os serviços sejam executados por empresa especializada, com observância às normas técnicas, de segurança e às boas práticas aplicáveis.

2.7. Alinhamento com o Planejamento Estratégico:

2.7.1 Ressalte-se que o objeto demandado encontra-se alinhado ao Planejamento Estratégico de Contratações da Secretaria Municipal de Saúde, bem como está previsto no Plano Anual de Contratações (PCA) referente ao presente exercício financeiro, conforme pode ser verificado na publicação realizada no Portal Nacional de Contratações Públicas – PNCP: <https://pncp.gov.br/app/pca/27142702000166/2026/1>

3. Especificação do equipamento:

3.1. O equipamento possui as seguintes características:

Nº. STEMAC – ST 0055004124

Motor: WEI_BAUD - Modelo: 4M06G50_6 - Nº: BJ11299347

Gerador: WEG - Modelo: GTA_201AI20_B15T - Nº: 1096700647 - Potência KVA: 55

Quadro: DS4520 - Ligado em: 220 - 60

4. Prazo de Serviços:

4.1 Levando em consideração o prazo demandado para Planejamento da Contratação e Seleção do prestador de serviços, com suas respectivas etapas: Estudos Preliminares, Identificação de Riscos, Elaboração de Termo de Referência, Pesquisa Mercadológica e Seleção do(s) Fornecedor(es), concluímos que a contratação deve ser realizada em 30 (trinta) dias e a execução deverá ser iniciada em até 10 (dez) dias após a expedição da Autorização de Serviços.

5. Local e Horário da Entrega:

4.2 O Complexo de Saúde de Aracruz fica localizado na Rua Lúcia Bitti Devéns, s/n - Jequitibá, Aracruz - ES, 29193-051

6. Unidade e servidor responsável para esclarecimentos:



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ANDREIA SILVA DE LIMA – Gerente do Complexo de Saúde de Aracruz

7. Indicação dos membros da Equipe de Planejamento:

FUNÇÃO	NOME DO(A) SERVIDOR(A)	MATRÍCULA
Integrante Requisitante	ARIDEIA PERUCH CUNHA	37852
Integrante Administrativo	MARCELA VALENTIM DE VARGAS	40430

Aracruz/ES, 05 de janeiro de 2025

ANDREIA SILVA DE LIMA

Gerente do Complexo de Saúde de Aracruz

Em conformidade com a legislação que rege o tema, encaminhe-se à autoridade competente para análise de conveniência e oportunidade para a aquisição e demais providências cabíveis.



RECEBEMOS DE STEMAC S/A GRUPOS GERADORES OS PRODUTOS E/OU SERVIÇOS CONSTANTES DA NOTA FISCAL ELETRÔNICA INDICADA ABAIXO. EMISSÃO: 26/04/2024 VALOR TOTAL: R\$ 75.600,00 DESTINATÁRIO: ENVIX ENGENHARIA LTDA - R PAULO DE VASCONCELOS, 155 JABOUR VITORIA-ES

DATA DE RECEBIMENTO

IDENTIFICAÇÃO E ASSINATURA DO RECEBEDOR

NF-e

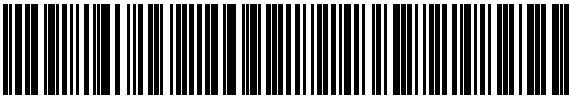
Nº. 000.156.747

Série 001

IDENTIFICAÇÃO DO EMITENTE

STEMAC S/A GRUPOS GERADORES
Rodovia Rodovia BR 153, 7015
Agroindistrial - 75515-610
ITUMBIARA - GO Fone/Fax: 6421035900

DANFE
Documento Auxiliar da Nota Fiscal Eletrônica
0 - ENTRADA
1 - SAÍDA
Nº. 000.156.747
Série 001
Folha 1/1



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CNPJ
92.753.268/0052-62

DESTINATÁRIO / REMETENTE
NOME / RAZÃO SOCIAL
ENVIX ENGENHARIA LTDA

CNPJ / CPF
06.274.118/0001-94

DATA DA EMISSÃO
26/04/2024

ENDEREÇO
R PAULO DE VASCONCELOS, 155

BAIRRO / DISTRITO
JABOUR

CEP
29072-210

DATA DA SAÍDA/ENTRADA
26/04/2024

MUNICÍPIO
VITORIA

UF
ES

FONE / FAX
2733270608

INSCRIÇÃO ESTADUAL

HORA DA SAÍDA/ENTRADA
11:16:30

CÁLCULO DO IMPOSTO								
BASE DE CÁLC. DO ICMS	VALOR DO ICMS	BASE DE CÁLC. ICMS S.T.	VALOR DO ICMS SUBST.	V. IMP. IMPORTAÇÃO	V. ICMS UF REMET.	V. FCP UF DEST.	VALOR DO PIS	V. TOTAL PRODUTOS
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VALOR DO FRETE	VALOR DO SEGURO	DESCONTO	OUTRAS DESPESAS	VALOR TOTAL IPI	V. ICMS UF DEST.	V. TOT. TRIB.	VALOR DA COFINS	V. TOTAL DA NOTA
0,00	0,00		0,00	0,00	0, 00	0, 00	5.056,13	75.600,00

TRANSPORTADOR / VOLUMES TRANSPORTADOS

NOME / RAZÃO SOCIAL
RV TRANSPORTE LTDA

FRETE
0-Por conta do Rem

CÓDIGO ANTT

PLACA DO VEÍCULO

UF

CNPJ / CPF
34.719.748/0001-60

ENDEREÇO
VIA EXPRESSA JULIO BORGES DE 4870

MUNICÍPIO
ITUMBIARA

UF
GO

INSCRIÇÃO ESTADUAL
107754770

QUANTIDADE
1

ESPÉCIE

MARCA

NUMERAÇÃO

PESO BRUTO
802,000

PESO LÍQUIDO
802,000

DADOS DOS PRODUTOS / SERVIÇOS														
CÓDIGO PRODUTO	DESCRIÇÃO DO PRODUTO / SERVIÇO	NCM/SH	O/CST	CFOP	UN	QUANT	VALOR UNIT	VALOR TOTAL	VALOR DESC	B.CÁLC ICMS	VALOR ICMS	VALOR IPI	ALÍQ. ICMS	ALÍQ. IPI
15600550113000	GMG CONT SL 0055KVA 220V 60HZ 3F pFCPUFDest=0,00% pICMSUFDest=0,00% pICMSInterPart=100,00% vFCPUFDest=0,00 vICMSUFDest=0,00 vICMSUFRemet=0,00	85021110	000	6116	PC	1,0000	75.600,0000	75.600,00	0,00	75.600,00	9.072,00		12,00	

DADOS ADICIONAIS

INFORMAÇÕES COMPLEMENTARES
Inf. Contribuinte: A presente N.Fiscal corresponde a N/NF. de venda 000156485 1 de 23.04.2024 NOTA FISCAL EMITIDA NOS TERMOS DO ARTIGO 31, DO ANEXO XII DO DECRETO N 4852/97 RICMS/GO Doc. Venda: 576552 Tipo: ZREF Pedido de compra: OC 13668 + E MAIL OBRA: CEMA ARACRUZ G MG MONTADO EM CONTEINER SILENCIADO LEVE SL MOTOR: BJ11299347 GERADOR: 1096700647 ENDERECO DE ENTREGA EM CANTEIRO DE OBRAS: CEMA Centro de Especialidades Medicas de Aracruz. Rua Lucia Bitti Devens, S/N, Bairro Jequitiba, Aracruz/ES. CEP 29.193 051. B ASE LEGAL Art. 466, . 3. RICMS/ES. Alíquota de 12 cfe Art. 20, inciso II, alínea "m", da Lei n 7.000/20 da Lei n 7.000/2001. Grupo Gerador Serie Nr.: ST0055004124

RESERVADO AO FISCO

Synchronous Alternators

G Line

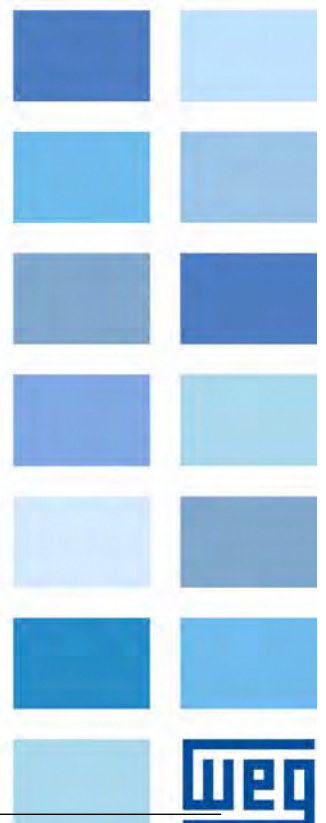
Alternadores Sincrónicos

Línea G

Alternadores Síncronos

Linha G

Installation, Operation and Maintenance Manual
Manual de Instalación, Operación y Mantenimiento
Manual de Instalação, Operação e Manutenção





Installation, Operation and Maintenance Manual **Manual de Instalación, Operación y Mantenimiento** **Manual de Instalação, Operação e Manutenção**

Document # / N° do documento: 10680382

Models / Modelos: GTA, GTF, GTW, GTK, GPA, GPF, GPW, GSA,
GSF, GSW and GSK

Language / Idioma: English / Español / Português

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May / Mayo / Maio, 2012



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Español

Manual de Instalação, Operação e Manutenção
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Português





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Dear Customer,

Thank you for purchasing the WEG alternator. It is a product developed with quality and efficiency levels that ensure optimal performance.

Electricity plays a role of major importance for the comfort and well-being of humanity. Since the alternator is responsible for generating this energy, this must be identified and treated as a machine whose characteristics include certain care, among them storage, installation, operation and maintenance.

All efforts were made to the information contained herein are truthful to the settings and use of the alternator.

Thus, we recommend reading this manual carefully before proceeding to installation, operation or maintenance of the alternator to ensure continuous and safe operation of the alternator and ensure your safety and of your facilities. If doubts persist, please refer to WEG.

Always keep this manual near the alternator, so it can be consulted whenever necessary.



ATTENTION

1. It is imperative to follow the procedures in this manual for the warranty to be valid;
2. The procedures for installation, operation and maintenance of the alternator should be done by qualified people.



NOTES

1. Reproduction of information in this manual, in whole or in part, is permitted provided that the source is quoted;
2. If this manual is lost, a copy in electronic format may be obtained by contacting www.weg.net or another printed copy may be requested from WEG.

WEG EQUIPAMENTOS ELÉTRICOS S.A.





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1 INTRODUCTION

This manual aims the assistance of the alternators G line. Alternators with specialties can be provided with specific documents (drawings, wiring diagrams, curve features, etc.). These documents must be carefully evaluated with this manual before proceeding with the installation, operation or maintenance of the alternator.

Refer to WEG if there is a need for some additional clarification. All procedures and standards contained in this manual should be followed to ensure the smooth operation of the alternator and safety of professionals involved in its operation. Observing these procedures is also important to ensure the warranty on the alternator. Therefore, we recommend reading this manual thoroughly before installation and operation of the alternator. If doubts persist, please refer to WEG.



ATTENTION

In case of exchange of the components mentioned in this manual the manufacturing date of the alternator must be observed in relation to the date of review of the manual.

1.1 SAFETY WARNINGS IN THE MANUAL

In this manual the following safety warnings are used:



DANGER

Failure to observe the procedures recommended in this warning may result in substantial property damage, serious injury or death.



ATTENTION

Failure to observe the procedures recommended in this warning may result in property damage.



NOTE

The text with this warning is intended to provide important information for the correct understanding and proper functioning of the product.



1.2 NOMENCLATURE

G T A 16 1 A I SR

G - Synchronous Machine - G Line

EXCITATION CHARACTERISTIC

T - Brushless alternator with auxiliary coil

P - Brushless alternator with auxiliary exciter (PMG)

S - Brushless alternator without auxiliary coil and without auxiliary exciter

TYPE OF COOLING

A - Open self-ventilated

F - Closed with heat exchanger air-air

W - Closed with heat exchanger air-water

K - Closed with finned frame

FRAME - IEC

16 - frame 160

20 - frame 200

...

FRAME LENGTH

1 - Short frame

2 - Medium frame

3 - Long frame

VOLTAGE

A - Three-phase - 12 terminals - 480/240V - 440/220V - 380/190V - 208V (60 Hz)
400/200V, 380/220/190V, 50Hz)

B - Three-phase - 6 terminals - 220V/60Hz or 190V/50Hz

C - Three-phase - 6 terminals - 380V/60Hz

D - Three-phase - 6 terminals - 440V/60Hz or 380V/50Hz

E - Three-phase - 6 terminals - 480V/60Hz or 400V/50Hz

F - Three-phase - 6 terminals - 600V/60Hz or 575V/60Hz

G - Three-phase - 6 terminals - 208V/60Hz

H - Three-phase - 6 terminals - 415V/50HZ

I - Three-phase - 6 terminals - 2300V/60Hz

J - Three-phase - 6 terminals - 4160V/60HZ

K - Three-phase - 6 terminals - 6600V/60Hz

L - Three-phase - 6 terminals - 13800V/60Hz

M - Three-phase - 6 terminals - 3300V/50Hz

N - Three-phase - 6 terminals - 6000V/50Hz

O - Three-phase - 6 terminals - 11000V/50Hz

P - Three-phase - 12 terminals - 415/240/208/120V (50Hz)

Z - Another Voltage

APPLICATION

I - Industrial

M - Marine

T - Telecommunications

N - Naval

E - Special

COMPLEMENTARY CODE

Code referent to alternator power



2 GENERAL INSTRUCTIONS

Professionals who work with electrical installations, either in assembly, operation or maintenance, should be continuously updated and be informed about rules and safety regulations governing the service and are advised to observe them strictly. Before the initiation of any work, the responsible person must ensure that everything was properly noticed and alert operators to the dangers inherent in the task to be performed. Alternators of this type, if used improperly or receive poor maintenance, or when people do not receive the intervention of not qualified personnel may cause serious personal injury and/or material damage. It is therefore recommended that these services be always performed by qualified people.

2.1 QUALIFIED PEOPLE

It is understood by people qualified those professionals who, because of their training, experience, education level, knowledge of relevant standards, specifications, safety standards, accident prevention and knowledge of operating conditions, have been authorized by their leaders to carry out the work required and that can recognize and avoid potential danger.

These qualified people must also know the first aid procedures and be able to provide such service if necessary.

It is assumed that all work of commissioning, maintenance and repairs are done only by qualified people.

2.2 SAFETY INSTRUCTIONS



DANGER

During operation, these devices have exposed energized or rotating parts, which may have high voltage or high temperature. Thus the operation with open terminal boxes, unprotected couplings, or incorrect handling without considering the standards of operation may cause serious injury and property damage.

Those responsible for safety of the facility must ensure that:

- Only qualified people perform installation and operation of equipment;
- These people have in hand this manual and other documents provided with the alternator, as well as perform the work strictly observing the instructions of service, relevant standards and documentation of specific products.

Failure to comply with installation standards and safety may void the warranty.

Equipment for fire fighting and first aid notices should be at work in clearly visible and easily accessible places.

Please also notice:

- All technical data about the applications permitted (operating conditions, connections and installation environment) contained in the catalog, documentation of the application, operating instructions, manuals and other documents;
- The specific determinations and conditions to the installation site;
- The use of tools and equipment suitable for handling and transport;
- That protective devices of the individual components be removed before installation.

The individual parts must be stored in an environment free of vibrations, preventing falls and ensuring that they are protected against aggressive and / or endanger the safety of people.

2.3 STANDARDS

Alternators are specified, designed, manufactured and tested according to the following standards:

Table 2.1: Applicable standards

	IEC	NBR	ISO
Specification	60034-1	5117	
Dimensions	60072	5432	
Tests	60034-4	5052	
Protection degrees	60034-5	9884	
Cooling	60034-6	5110	
Mounting	60034-7	5031	
Noise	60034-14	5117	8528

2.4 ENVIRONMENT FEATURES

In accordance with IEC 60034.1, and ABNT 5117, the ambient operating conditions for which the alternators were designed are the following:

1. Ambient temperature: – 15°C to + 40°C;
2. Altitude (sea level): up to 1000 m;
3. Environment without the presence of aggressive agents such as: salt spray, chemicals, etc.;
4. Environment according to the protection degree of the alternator.

Special conditions of environment are described on the rating plate and specific technical data sheet of the alternator.



ATTENTION

For use of alternators with water cooling at temperatures below 0°C, antifreeze additives must be added in water.

2.4.1 Harsh or marine environment

The industry standard alternator should not be used in harsh environments, because this action is subject to weather that can cause corrosion of mechanical parts and decrease the insulation resistance of the windings and consequently the burning of the alternator. In these situations, WEG is not responsible for damage that may occur on the alternator, depriving the product warranty according to the warranty terms.





NOTE

Alternators applied in harsh environments should be equipped with additional protection against corrosion and poor insulation, ensuring, when requested, to guarantee performance of the product.

Is considered harsh environment: marine environment or with high concentration of salinity and / or high humidity, materials in suspension that can be abrasive, and naval application with high ambient temperature variation. In these cases, please refer to WEG for correct specification of the alternator to the required application.

2.5 OPERATING CONDITIONS

For the warranty term of the product to be valid, the alternator must operate according to the nominal data, follow the standards and codes and the information contained herein.



3 RECEIPT, STORAGE AND HANDLING

3.1 RECEIPT

All supplied alternators are tested and are in proper operating condition. The machined surfaces are protected against corrosion. The packaging must be checked immediately upon receipt to verify that it has not suffered damage during transport.



ATTENTION

Any damage must be photographed, documented and reported immediately to the carrier, the insurer and to WEG. The lack of notice will void the warranty.



ATTENTION

Additional parts supplied in packages should be checked on receipt.

- When lifting the package, the correct locations for lifting, the weight stated in the documentation and / or on the nameplate must be observed, as well as the capacity and operation of lifting devices;
- Alternators packed in wooden crates should always be raised by their own eyebolts or by appropriate forklift, but should never be raised by their timbers;
- The package can never be overturned. Place on the ground carefully (without causing impacts) to avoid damage to the bearings;
- Do not remove the grease for corrosion protection of the end of the shaft, flange and coupling discs nor the plugs closing holes of the terminal boxes;
- These protections should remain in place until the final assembly. After unpacking, you should make a complete visual inspection of the alternator;
- The shaft locking system should be removed just before the installation and stored in a safe place to be used in any future transportation of the alternator.

3.2 STORAGE

Any damage to paint or rust protections of machined parts to be retouched.



ATTENTION

During storage, the heating elements (if any) must remain connected to prevent water condensation inside the alternator.

3.2.1 Storage in sheltered environment

If the alternator is not installed immediately upon receipt, it shall remain in the packaging and stored in a place protected from moisture, steam, rapid changes in heat, rodents, insects and other agents that may damage the machine.

For the bearings not to be damaged, the alternator must be stored at locations free of vibration.

3.2.2 Storage in not sheltered environment

The alternator should be stored in dry place, free from floods and vibration.

Repair any damage in the package before storing the alternator, which is needed to ensure proper storage conditions.

Place the alternator on platforms or foundations that ensure protection against soil moisture and prevent it from sinking into the ground. Free movement of air underneath the alternator should be ensured.

The cover or tarpaulin used to protect the alternator against the weather should not be in contact with its surfaces. To ensure the free circulation of air between the alternator and the the coverage, put wooden blocks as spacers.

3.2.3 Longer storage

When the alternator is stored, the empty spaces inside, bearings, connection box and windings are exposed to air humidity, which can condense. Depending on the type and degree of air pollution, also aggressive substances can penetrate these voids.

As a result, after prolonged storage, the resistance of the winding insulation can be reduced to below permissible values. Internal components such as bearings can oxidize and lubricity of the lubricant may be affected.

All these influences increase the risk for damage before the operation of the alternator.



ATTENTION

To avoid losing the guarantee of the alternator, you should ensure that all preventive measures described in this manual are followed and recorded.

The instructions outlined below are valid for alternators which are stored for long periods and / or are out of operation **for a period of two months** or more.

3.2.3.1 Storage location

To ensure the best storage conditions for long periods of the alternator, the location should comply strictly with the criteria described below.

3.2.3.1.1 Storage in sheltered environment

- The environment must be closed and covered;
- The location must be protected against moisture, vapors, aggressive agents, rodents and insects;
- There must be no the presence of corrosive gases such as chlorine, sulfur dioxide or acids;
- The environment must be free of continuous or intermittent vibration;
- The environment must have ventilation system with air filter;
- Ambient temperature between 5 ° C and 60 ° C, there should not be sudden fluctuation in temperature;
- Relative air humidity <50%;
- It must have prevention against dirt and dust;
- It must have fire detection system;
- It must be provided with electricity to supply the heating elements (if any).



If any of these requirements is not met in place of storage, WEG suggests that additional protections are incorporated in the packaging of the alternator during the storage period, as follows:

- Closed wooden box or similar with wiring that allows the heating elements (if any) to be energized;
- If there is a risk of infestation of fungus, the packaging should be protected on-site storage, spraying it or painting it with appropriate chemicals;
- The preparation of the package must be done carefully by a trained person.

3.2.3.1.2 Storage in not sheltered environment

It is not recommended to store the alternator in a not sheltered location.

If the storage at not sheltered environment cannot be avoided, the alternator must be packed in specific package for this condition, as follows:

- For storage at not sheltered environment, apart from the package recommended for internal storage, the packaging should be covered with a protection against dust, moisture and other foreign materials, using for this purpose a tarpaulin or sturdy plastic;
- Position the package on platforms or foundations that ensure protection against soil moisture, prevent it from sinking into the ground;
- Once the alternator is covered, a shelter should be erected to protect it from direct rain, snow or excessive heat from the sun.



ATTENTION

If the alternator is kept in storage for extended periods, it is recommended to regularly inspect it as specified in item **"Maintenance Plan during storage"** of this manual.

3.2.3.2 Separate parts

- If there have been supplied spare parts (terminal boxes, covers, etc.), these parts must be packed as specified in items 3.2.3.1.1 and 3.2.3.1.2.
- The relative humidity inside the package must not exceed 50%.

3.2.3.3 Space heater

The space heaters of the alternator (if any) should remain energized during the storage period to avoid condensation of moisture inside of the alternator and thus ensure that the insulation resistance of the windings remains at acceptable levels.



ATTENTION

The alternator space heaters must be connected when it is stored at room temperature $<5^{\circ}\text{C}$ and / or relative humidity $>50\%$.

3.2.3.4 Insulation resistance

During the storage period, the insulation resistance of the windings of the stator and exciter rotor of the alternator must be measured and recorded every three months prior to installation of the alternator.

Any decrease in value of insulation resistance should be investigated.

3.2.3.5 Exposed machined surfaces

All exposed machined surfaces (e.g., the shaft end, flange, coupling disc) are protected at the factory with a temporary protective agent (rust inhibitor).

This protective coating must be reapplied at least every 6 months or when it is removed and/ or damaged.

Recommended Products:

Name: Dasco Guard 400 TX AZ, Manufacturer: D.A. Stuart Ltda

Name: TARP, Manufacturer: Castrol.

3.2.3.6 Bearings

3.2.3.6.1 Shielded bearings (frame up to 315)

During the storage period, every two months, the locking device of the shaft should be removed and rotated manually to distribute the grease inside the bearing and keep it in good conditions. If the alternator is kept in storage for a period greater than two years, the bearings should be replaced.

3.2.3.6.2 Regreasable bearings (frame up to 355)

The bearings are lubricated at the factory for testing. During the storage period, every two months, the locking device of the shaft should be removed and rotated manually to distribute the grease inside the bearing and keep it in good conditions. After 6 months of storage and before the entry into operation, the bearings must be relubricated. If the alternator is kept in storage for a period greater than two years, the bearings should be cleaned, inspected to ensure its integrity and relubricated.



ATTENTION

If it is not possible to rotate the shaft of the alternator, as recommended, check the condition of the bearing before putting the alternator into operation.

3.2.3.7 Terminal box

When the insulation resistance of the windings of the alternator is measured, the main terminal box and the other terminal boxes should also be inspected, especially considering the following:

- The inside must be dry, clean and free of dust deposition;
- The contacts must not be corroded;
- The seals should be in proper condition;
- The inlet of the cables must be properly sealed in accordance with the degree of protection of the machine.

If any of these items is not correct, cleaning or replacement of parts should be performed.

3.2.3.8 Inspection and records during storage

The alternator stored should be inspected periodically and inspection records must be filed.

The following aspects must be inspected:



1. Physical damage;
2. Cleaning;
3. Signs of water condensation;
4. Conditions of the protective coating of machined surfaces ;
5. Conditions of painting;
6. Signs of harsh agents;
7. Satisfactory operation of the space heaters (if any). . It is recommended that an alarm or signaling system be installed on site for detecting power interruption of the space heaters;
8. It is recommended to register the temperature and humidity surrounding the machine, the temperature of the winding insulation resistance and the rate of polarization;
9. Inspect the storage site that complies with the criteria described in the item "".

3.2.3.9 Preparation for operation start

3.2.3.9.1 Cleaning

- The inside and outside of the alternator must be free of oil, water, dust and dirt;
- Remove the rust inhibitor of the exposed surfaces with a cloth soaked in a petroleum-based solvent.

Make sure the bearings used for lubrication and cavities are free from dirt and properly sealed.

3.2.3.9.2 Lubrication of bearings

In alternators with regreasable bearings, relubricate the bearings using the specified lubricant. Information on bearings and lubricants, as well as the procedure for lubrication are indicated in the item **"Maintenance of Bearings"** in this manual.

3.2.3.9.3 Verification of insulation resistance



ATTENTION

Before putting the alternator into operation the insulation resistance of the windings should be measured as in item **"Insulation Resistance"** of this manual.

3.2.3.9.4 Others

Follow all other procedures in the **Commissioning** item in this manual before putting the alternator into operation.



3.2.3.10 Maintenance plan during storage

During the storage period, maintenance of the alternator must be performed and recorded according to the plan described in Table 3.1.

Table 3.1: Storage plan

	Monthly	Every two months	Every six months	Every two years 2 years	Before going into operation	NOTE
Storage Location						
Inspect cleaning conditions		X			X	
Inspect humidity and temperature conditions		X				
Verify signs of harsh agents		X				
Measure vibration level	X					
Packaging						
Inspect physical damage			X			
Inspect inner relative humidity		X				
Replace the desiccant in the package (if any)			X			When necessary
Space heater (if any)						
Verify operation conditions	X					
Complete alternator						
Perform external cleaning			X		X	
Perform internal cleaning					X	
Verify painting conditions			X			
Verify the rust inhibitor on exposed parts			X			Replace inhibitor, if necessary
Windings						
Measure insulation resistance		X			X	
Measure polarization index		X			X	
Terminal boxes and grounding terminals						
Clean inside the terminal boxes				X	X	
Inspect seals				X	X	
Re-tighten the connection terminals					X	According to tightening torques informed herein
Regreasable roller bearings						
Rotate alternator shaft		X				
Relubricate the bearing			X		X	
Disassemble, clean, inspect and lubricate the bearing				X	X	If storage period is over 2 years
Shielded roller bearings						
Rotate alternator shaft		X				
Replace bearing				X		



3.3 HANDLING

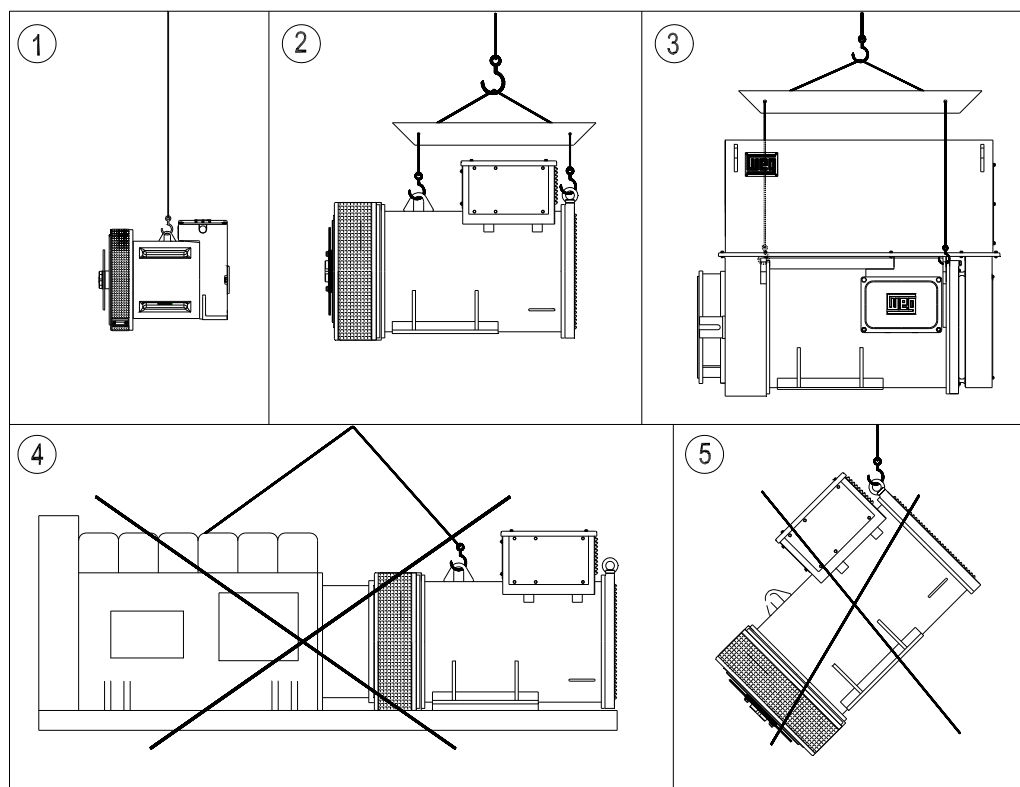


Figure 3.1: Handling of alternator

- Positions **1, 2 and 3** of Figure 3.1, represent the proper way of handling alternators and positions **4 and 5** show the wrong ways;
- The alternator was designed with eyebolts for its lifting. These eyebolts are designed to lift only the alternator, additional loads are not permitted;
- Cables and lifting devices must be appropriate.



NOTES

- Observe weight indicated.
- Do not lift and do not put the alternator on the ground suddenly thus avoiding damage to the bearings.
- To lift the alternator, use only the existing eyebolts. If necessary, use a crossbeam to protect parts of the alternator.
- The eyebolts on the covers, bearings, terminal box, etc., only serve to handle these components.
- Never use the shaft to lift the alternator.
- To move the alternator, it must be with the shaft locked with the locking device supplied with the alternator.
- After removal of the safety device from the front side, while lifting the alternator it should not be inclined with the front downwards at risk of falling of the rotor.



ATTENTION

Steel cables, clevises and lifting equipment must be appropriate and be capable of supporting the weight of the alternator, to avoid accidents, damage to the alternator or personal injury.



4 INSTALLATION

4.1 INSTALLATION LOCATION

The alternator must be installed in easily accessible locations, allowing the performance of periodic inspections, local maintenance and, if necessary, their removal for external services.

The following environmental features must be observed:

- The alternators should get fresh and clean air and the installation location must allow easy air exhaustion of the operating environment of the equipment, preventing air recirculation;
- It must be avoided that the alternator aspire the exhaust fumes of diesel engine, because soot is a conductor for electricity and shortens the life of the insulation and this may cause burning of the alternator;
- The installation of other equipment or walls should not hinder or obstruct the ventilation of the alternator;
- The space around and above the alternator should be sufficient for its maintenance or handling;
- The environment must be in accordance with the protection degree of the alternator.



NOTE

For generators with single bearing, the shaft locking device (used to protect the rotor /stator against damage during transport) shall be removed only just before coupling it to the driving machine.

4.2 DIRECTION OF ROTATION

The alternators of standard line G can operate in both directions of rotation.

The phase sequence is set to the *clockwise direction* of rotation (viewed facing the shaft end of the alternator - Powered Side).

The terminals of the alternators are marked in such a way that the sequence of terminals 1, 2 and 3 coincides with the sequence of phases R, S and T or L1, L2 and L3, when the direction of rotation is clockwise.

In the case of alternators that need to operate in a **counterclockwise** direction, the phase sequence must be changed (if required). It is recommended to check the rotation direction and sequence of phases required before the entry into operation of the alternator.



ATTENTION

The wrong sequence of phases may cause damage to equipment supplied by the alternator. In the case of parallel operation with other alternators and / or network, these must have the same phase sequence.

4.3 PROTECTION DEGREE

It is essential for the proper performance of the alternator and its durability, that the degree of protection for this equipment be observed in relation to the installation environment. The standard line G alternator has protection degree IP21 (protected against penetration of solid bodies of dimensions above 12 mm and splash of water in the vertical).

4.4 COOLING

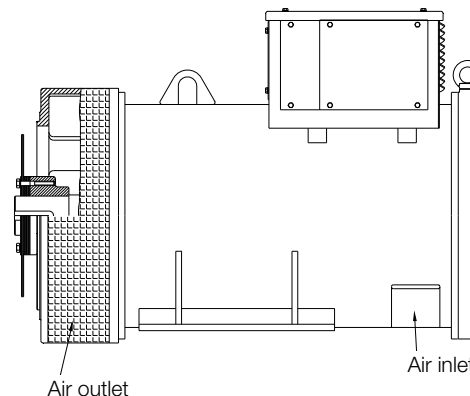


Figure 4.1: Cooling system

The fan is fitted to the drive end near the rotor. Air enters through the non-drive end and goes out by radial openings in the cover / flange on the drive end.

4.5 INSULATION RESISTANCE

4.5.1 Safety instructions



DANGER

Before making the measurement of insulation resistance, the alternator must be stopped and unplugged from the load and the voltage regulator unplugged.

The winding being tested must be connected to the frame and ground for a period until removing the residual electrostatic charge.

Failure to follow these procedures may result in personal injury.

4.5.2 General considerations

When the alternator is not immediately placed into operation, it must be protected against moisture, dirt and high temperature, thus avoiding that the insulation resistance

The insulation resistance of the windings must be measured before entry into operation.

If the environment is too humid, it is necessary to check it periodically during storage. It is difficult to determine rules for the real value of insulation resistance of a machine, since it varies with environmental conditions (temperature, humidity), conditions of machine cleaning (dust, oil, grease, dirt) and quality and conditions the insulating material used.

The evaluation of the periodic monitoring records is useful to conclude whether the motor is able to operate.



NOTE

The insulation resistance must be measured using a **MEGOHMMETER**.

4.5.3 Measurement of the stator winding

The test voltage to the stator windings of the alternators must be as Table 4.1 in accordance with standard IEEE43.



Table 4.1: Voltage for measurement of the insulation resistance

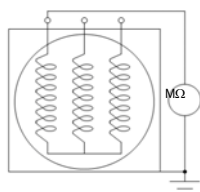
Winding nominal voltage (V)	Insulation resistance test Continuous voltage (V)
< 1000	500
1000 - 2500	500 - 1000
2501 - 5000	1000 - 2500
5001 - 12000	2500 - 5000
> 12000	5000 - 10000

Before measuring the stator winding, check the following:

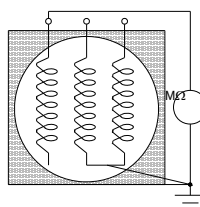
- If all load cables are disconnected;
- If the voltage regulator is disconnected;
- If the frame of the alternator and the windings not measured are grounded;
- If the temperature of the winding has been measured;
- If all temperature sensors are grounded;

The measurement of the insulation resistance of the stator windings must be made in the main terminal box.

The meter (megohmmeter) must be connected between the frame of the alternator and the winding. The frame must be grounded and the three phases of the stator winding remain connected to the neutral point, as shown below:

**Figure 4.2:** Measurement in the three phases

Whenever possible each phase must be insulated and tested separately. The separate test allows the comparison between the phases. When a phase is tested, the other two phases must be grounded on the same grounding of the frame, as shown below.

**Figure 4.3:** Measurement in separate phases

4.5.4 Measurement in the rotor winding, exciter and accessories

Measurement of the rotor winding

- Disconnect rotor cables of the set of diodes;
- Connect the Insulation resistance meter (megohmmeter) between the rotor winding and the shaft of the alternator. The measurement current cannot pass through the bearings.

Measurement of the stator winding of main exciter.

- Disconnect the power cables from the exciter;
- Connect the Insulation resistance meter (megohmmeter) between the stator winding of the exciter (terminals I and K) and the frame of the alternator.

Measurement of the rotor winding of main exciter.

- Disconnect exciter rotor cables of the set of diodes;
- Connect the Insulation resistance meter (megohmmeter) between the rotor winding and the

shaft of the alternator. The measurement current cannot pass through the bearings.

Measurement of the stator winding of the auxiliary exciter (PMG) - alternators model GP-- :

- Disconnect cables that connect the auxiliary exciter to the voltage regulator;
- Connect the Insulation resistance meter (megohmmeter) between the stator winding of the auxiliary exciter and the frame of the alternator.



ATTENTION

The test voltage for the rotor, main exciter, auxiliary exciter and space heater must be 500VDC and other accessories 100VDC. It is not recommended the measuring of insulation resistance of thermal protectors.

On machines that are already in operation, higher values of insulation resistance, can be obtained compared to the initial values for commissioning.

The comparison with values obtained in previous tests on the same machine, in similar conditions of load, temperature and humidity serves as a better indication of the conditions of isolation than the value obtained in a single test, and any sudden reduction is considered suspicious.

Table 4.2: Limits for orientation of the insulation resistance in electrical machines

Insulation resistance value	Evaluation of insulation
2MΩ or lower	Dangerous
< 50MΩ	Bad
50...100MΩ	Regular
100...500MΩ	Good
500...1000MΩ	Very Good
> 1000MΩ	Excellent

4.5.5 Minimum insulation resistance

- If the measured insulation resistance is less than 100 MΩ at 40 ° C, the windings must be carefully inspected and cleaned or, if appropriate, dried according to the following procedure before the machine gets into operation:
- Disassemble the alternator by removing the rotor and bearings;
- Place the winding components which have low insulation resistance in an oven and heat them at a temperature of 130°C, keeping this temperature for at least 08 hours.
- Check the insulation resistance is achieved within acceptable values, as Table 4.2, otherwise refer to WEG.

4.5.6 Polarization index

The polarization index (P.I) is typically defined as the ratio between the measured insulation resistance in 10 min. and insulation resistance measured in 1 min. with relatively constant temperature. Using the index of polarization, isolation conditions of the alternator can be evaluated according to Table 4.3.



Table 4.3: Polarization index (ratio between 10 and 1 minute)

Polarization index	Evaluation of insulation
1 or lower	Dangerous
< 1.5	Bad
1.5 to 2.0	Regular
2.0 to 3.0	Good
3.0 to 4.0	Very Good
> 4.0	Excellent


DANGER

Immediately after measuring the insulation resistance, ground the winding to prevent accidents.

4.5.7 Conversion of the measured values

If the test is done at a different temperature, it is necessary to correct the reading to 40°C, using a curve of variation of the insulation resistance in relation to the temperature, raised with the machine itself. If this curve is not available, the approximate correction provided by the curve in Figure 4.4 can be employed, according to NBR 5383 / IEEE43.

4.6 PROTECTION

4.6.1 Thermal protection

Alternators have, when requested by the client, protective devices against excessive rise in temperature, installed in the stator coils, and / or bearings, as follows:

Thermostat (bimetal): bimetallic thermal detectors, with normally closed silver contacts that open when they reach the temperature of operation. Thermostats can be connected in series or independently according to wiring diagram.

Thermistors (PTC or NTC type): Heat detectors, semiconductor compounds that vary their resistance sharply to reach the temperature of operation. Thermistors can be connected in series or independently according to wiring diagram.

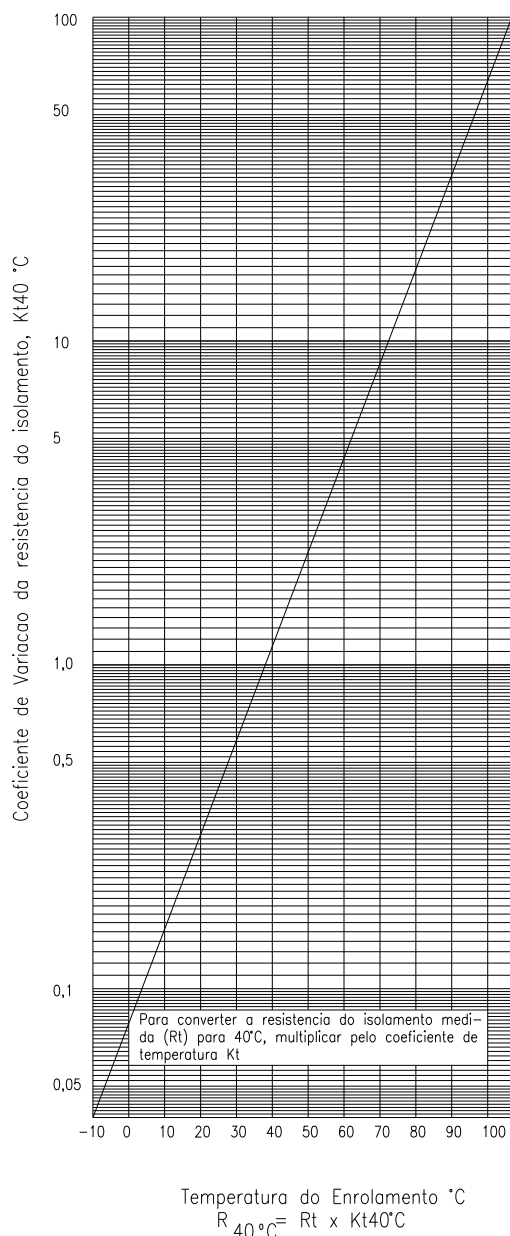

NOTE

Thermostats and thermistors must be connected to a control unit that stops operation of the alternator or triggers a signaling device.

Thermistor (RTD) - A calibrated resistance element. Its operation is based on the principle that the electrical resistance of a metallic conductor varies linearly with temperature. The terminals of the detector must be connected to a control panel which includes a temperature gauge.


NOTE

The thermistors type RTD allow monitoring of the absolute temperature. With this information, the relay can do the temperature reading, as well as the parameterization for alarm and shutdown according to the preset temperatures.


Figure 4.4: Coefficient of variation of insulation resistance with temperature

The following formula is used to convert the value of the ohmic resistance of the temperature measurement for thermistors Type Pt 100.

$$\text{Formula: } \frac{\Omega - 100}{0.386} = ^\circ\text{C}$$

Where: Ω = ohmic resistance measured on the PT-100

The protective devices, when requested, are listed in the wiring diagram specific to each alternator. The non-use of these devices is the sole responsibility of the user, but may result in loss of guarantee in case of damage.

4.6.1.1 Temperature limits for the windings

The temperature of the hottest point of the winding must be kept below the limit of thermal class of insulation. The total temperature is composed of the sum of temperature with the rise of temperature (ΔT), plus the difference between the average temperature of the winding and the



hottest point of the winding. The ambient temperature is typically up to 40°C. Above this value, the working conditions are considered special. Table 4.4 shows the numerical values and composition of the permitted temperature of the hottest point of the winding.

Table 4.4: Insulation class

Insulation class		F	H
Ambient temperature	°C	40	40
T = temperature rise (resistance method)	°C	105	125
Difference between the hottest point and the average temperature	°C	10	15
Total: Temperature of the hottest point	°C	155	180



ATTENTION

If the alternator works with winding temperatures above the limits of thermal class, the life of the insulation and hence of the alternator is reduced substantially, or even may cause burning of the alternator.

4.6.1.2 Thermal protection for the bearings

The temperature sensors installed on the bearings (if any) are used to protect them from damage due to operation with overheating.

4.6.1.3 Temperatures for alarm and shutdown

Temperature of alarm and shutdown must be parameterized as low as possible. These temperatures can be determined based on the results of tests or by operating temperature of the alternator. The temperature alarm can be set to 10°C above the operating temperature of the alternator at full load considering the highest ambient temperature at the location. The temperature set to shutdown shall not exceed the maximum permitted temperatures as listed in Table 4.5 and Table 4.6.

Table 4.5: Maximum temperature of stator - continuous duty

STATOR WINDING		
Class of Insulation	Maximum temperature of protection setting (°C)	
	Alarm	Shutdown
F	140	155
H	155	180



ATTENTION

Alternators used in emergency systems (standby) can be elevated up to 25 °C above the temperature in continuous operation as standard NEMA MG 1 and MG-22:40-1-22.84. Using the alternator in these conditions reduces the life of the alternator.

Table 4.6: Maximum temperature of the bearings

BEARINGS	
Maximum temperature of protection setting (°C)	
Alarm	Shutdown
110	120



ATTENTION

The temperature alarm and shutdown can be set based on experience, but must not exceed the maximum rate indicated in the tables Table 4.5 and Table 4.6.

4.6.2 Space heater

When the alternator is equipped with a heater to prevent condensation of water for long periods without operation, they must be programmed to be always energized after the shutdown of the alternator and be deenergized before the switch goes into operation.

The dimensional drawing and an existing specific identification plate on the alternator indicate the value of supply voltage and power of the installed space heaters.



ATTENTION

If the space heaters remain energized while the machine is in operation, the winding may be damaged.

4.6.2.1 Auxiliary winding protection

The alternator has a protection fuse, connected in series with the auxiliary winding or the voltage regulator, with the function of protecting it against overload.



ATTENTION

Failure to use the specified fuse may result in burning of the auxiliary coil and hence of the the stator winding. This defect is not covered under warranty.

In case of operation of the fuse it is necessary to replace it with another of equal value, so that the alternator operates properly protected.

The fuse protects the alternator and voltage regulator in the following situations:

1. Loss of reference (feedback) of the voltage regulator;
2. 4. Connection of the cables of the auxiliary coil in short circuit, done on output cables of the coil or by erroneous connection on the voltage regulator;
3. Connection of the output terminals of the voltage regulator in short circuit;
4. Operation at low speed (used to heat the diesel engine), especially with the function U / F voltage regulator disabled, depending on the operating condition (rotate, adjust the regulator and others);
5. In case of damage to the voltage regulator (burning of the power element or internal reference failure in the circuitry for comparison);

The fuse does not operate in case of short circuit of the alternator phases. In these cases, the protection should be done with a relay, allowing the motor starting and protection sensitization.

4.6.3 Protection of the diodes

The diodes are protected against overvoltage and / or power surge, according to Table 4.7.

In case of failure of these components, they must be replaced.



Table 4.7: Protection of the diodes

	Varistor	Capacitor
GTA161 - GTA252	✓	
GTA311 - GTA561	✓	✓
Type of assembly	THT	THT
Item (WEG)	10049848	10391625
Features	1W, 745Vcc, 550Vca 210J/2ms	0,1µf, 2000Vcc, 630Vca

4.6.4 Protection of the voltage regulator

4.6.4.1 Protection against underfrequency

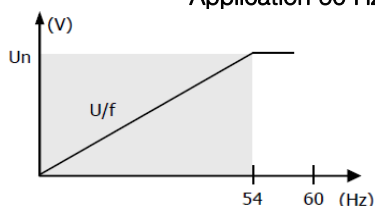
To put the alternator into operation, the underfrequency protection of the voltage regulator should be set at 90% the nominal frequency (already set at the factory) or stay with the voltage regulator off until the group reaches the rated speed, avoiding overcurrent in the auxiliary coil windings and excitation of the alternator.



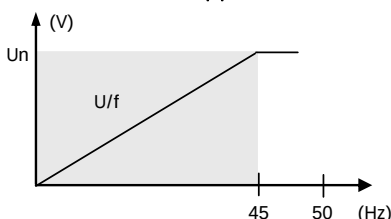
NOTE

The other protections of the voltage regulator are described in the manual specific to it.

Application 60 HZ



Application 50 HZ



4.7 VOLTAGE REGULATOR

The electronic voltage regulator is designed to keep the voltage of the alternator constant independently of load. It may be mounted in the connection from the alternator or on the control panel.



ATTENTION

Check in the **Manual of the voltage regulator** the terminals and wiring diagram and trimpots for adjustment. A wrong connection can mean the burning of the regulator and / or the alternator windings. Defects caused by this reason are not covered under warranty.

For further technical details of the operation, functions, connections, settings and anomalies, etc, refer to the specific manual of the voltage regulator.

4.7.1 Maintenance of the short-circuit current

The alternators WEG line G are manufactured with the auxiliary winding placed in slots of the main stator isolated from the main winding. This coil has the function of feeding the power circuit of the voltage regulator and to maintain the short-circuit current of the alternator.



NOTE

1. Due to the fact of the alternator to keep high Icc, an overcurrent relay must be provided and to open the main breaker in no more than 20s, under risk of burning the alternator.
2. To maintain the short circuit current above $3.0 \times I_n$, refer to WEG.

4.8 ELECTRICAL FEATURES

4.8.1 Electrical connections

The electrical connections of the alternator are responsibility of the end user and should be done by trained people. The connection diagrams can be found in item 4.8.2.

4.8.1.1 Main connection

The main cable connections must be made in accordance with the diagrams in this manual, using tightening torque according to Table 4.8 for fixing cables.

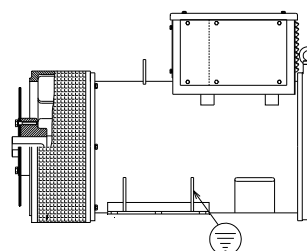
Table 4.8: Tightening torque of terminal screws for fixing the main cables

Screw diameter	Tightening torque (Nm)
M5	5-6
M8	20-25
M10	39-49
M12	64-84
M16	165-206

- Make sure the section and insulation of the connecting cables are suitable for the current and voltage of the alternator;
- Before making electrical connections between the alternator and the load or power network, it is required to do a careful check of the insulation resistance of the winding, as shown in Table 4.2.

4.8.1.2 Grounding

The alternator must always be grounded with a cable with suitable section, using the terminal located in one of the feet thereof.


Figure 4.5: Grounding


4.8.1.3 Electronic voltage regulator

The electronic regulator is factory set and electrically connected to the values of rated voltage and frequency of the alternator.

To change the settings or connections, consult the manual of the voltage regulator.



ATTENTION

When there is change in the main terminal connections from the alternator to voltage change, changing cable connections of the reference voltage of the regulator must also be made according to the particular diagram.

To change the operating frequency of the voltage regulator, refer to its manual.

4.8.1.4 Terminal identification

Main terminals (connection cables of the stator phases)
1 a 12, N

Connection terminals on the voltage regulator

E1 or E2 (brown) – Feedback of single-phase voltage.

E3/4 (green) – Common of the circuit of supply and of the feedback power of the single phase of the voltage regulator.

R (blue), **S**(gray) and **T**(orange) – feedback of three-phase voltage.

3 (yellow) – Supply of the power circuit of the voltage regulator.

F+ (red) and **F-** (black) – Main excitatory field

AX1 (blue), **AX2** (gray) and **AX3** (orange) – Auxiliary exciter
- supply of power circuit of the voltage regulator – model GPA.

N (white) – Feedback of single-phase voltage (GPA)

Terminals of accessories

16 to 19 – Space heaters

20 to 35 – Thermosensors on the stator (PT100)

36 to 51 – Thermistors on the stator (PTC)

52 to 67 – Thermostats on the stator

68 to 71 – Thermistors on the bearings

72 to 75 – Thermistors on the bearings

76 to 79 – Thermostats on the bearings

80 to 82 – Tachometric dynamos

88 to 91 – Thermometers

94 to 99 – Current Transformers



4.8.2 Connection diagrams

4.8.2.1 Three-phase alternators – 12 terminals – (frames 160 to 355)

WIRING DIAGRAM		Star Series (access to neutral)		Star Parallel (access to neutral)		Triangle Series	
VOLTAGE (V)							
60Hz	L - L	380 - 415	440 - 480	190-208	220 – 240	220 – 240	
	L - N	220 - 240	254 - 277	110-120	127 – 139	–	
	(Referência)	190 - 207	220 - 240	190-208	220 - 240	220 – 240	
50Hz	L - L	380 – 400		190 – 200		200 – 220	
	L - N	220 – 230		110 – 115		–	
	E1 - E3/4 (Reference)	190 – 200		190 – 200		200 – 220	
CONTACT BLOCK	8 pins		8 pins		8 pins		
12 pins - frame 315 - 355		12 pins - frame / 315 - 355		12 pins - frame / 315 – 355			



ATTENTION

- The alternator is supplied with the voltage regulator connected to the operating rated characteristics;
- In case of maintenance or modification of the connections from the alternator, check the cables E1, E3 / 4 and 3 on the voltage regulator (E1 - E3 / 4, reference voltage) and (3 - E3 / 4, power supply of the regulator);
- In alternators with 12 terminals, always connect the cables E1 - E3 / 4 of the alternator terminals E1 and E3 / 4 of the voltage regulator, regardless of connection type or the rated voltage of the alternator. **In these cases, terminal E2 of the voltage regulator should not be used.**

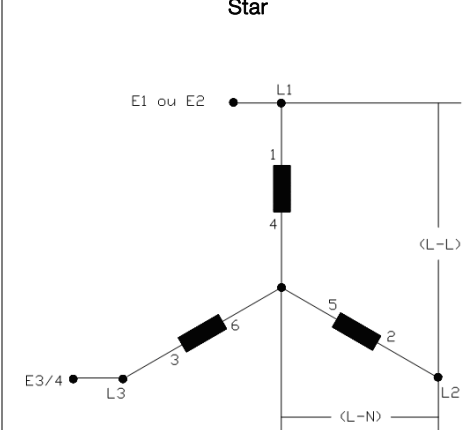
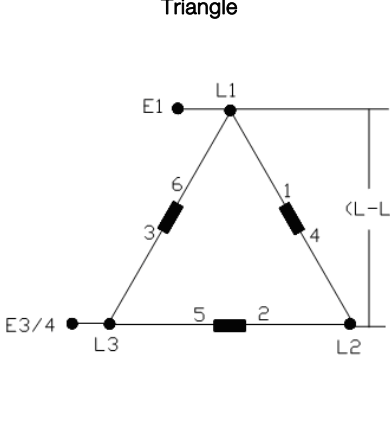
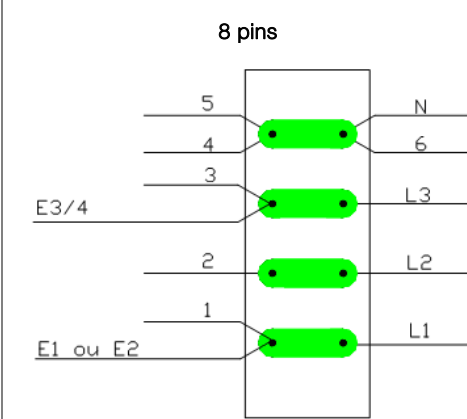
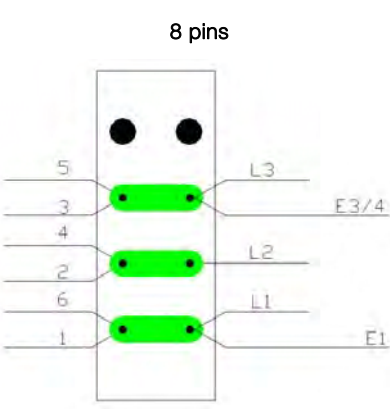


NOTE

To obtain the wiring diagrams of the alternator of frame 400 and higher, refer to WEG.



4.8.2.2 Three-phase alternators - 6 terminals - (frames 160 to 355)

WIRING DIAGRAM		Star						Triangle			
											
		VOLTAGE (V)									
60Hz	L - L	220	380	440	480	600	127	220	277	346	
	L - N	127	220	254	277	346	-	-	-	-	
	(E1 or E2) - E3/4 (Reference)	220 (E1)	380 (E2)	440 (E2)	480 (E2)	600 (E2)	127 (E1)	220 (E1)	277 (E1)	346 (E2)	
50Hz	L - L	190	380	400	415	110	220	230	240		
	L - N	110	220	230	240	-	-	-	-		
	(E1 or E2) - E3/4 (Reference)	190 (E1)	380 (E2)	400 (E2)	415 (E2)	110 (E1)	220 (E1)	230 (E1)	240 (E1)		
CONTACT BLOCK		8 pins						8 pins			
											



ATTENTION

- The alternator is supplied with the voltage regulator connected to the operating rated characteristics;
- In case of maintenance or modification of the connections of the alternator, check the cables E1 or E2, E3 / 4 and 3 on the voltage regulator (E1 or E2 - E3 / 4, reference voltage) and (3 -E3 / 4, power supply of the regulator) ;
- In WEG alternators with single voltage (6 or 3 terminals) from 160 to 300V, always connect the cables E1 - E3 / 4 of the alternator terminals E1 and E3 / 4 of the voltage regulator, as the diagrams above;
- In WEG alternators with single voltage (6 or 3 terminals) from 320 to 600V, always connect the cables E2 - E3 / 4 of the alternator terminals E2 and E3 / 4 of the voltage regulator, as the diagrams above.



NOTE

To obtain the wiring diagrams of the alternator of frame 400 and higher, refer to WEG.



4.8.2.3 Three-phase alternators with single-phase connection - 12 terminals

WIRING DIAGRAM		Single-phase zigzag parallel	Single-phase zigzag Series	Single-phase Triangle
		VOLTAGE (V)		
60Hz	L - L	200 - 240	440 - 480	220 - 240
	L - N	100 - 120	220 - 240	100 - 120
	E1 - E3/4	200 - 240	220 - 240	220 - 240
50Hz	L - L	190 - 220	380 - 400	190 - 220
	L - N	95 - 110	190 - 220	95 - 110
	E1 - E3/4	190 - 220	190 - 220	190 - 220
CONTACT BLOCK		8 pins	8 pins	8 pins
		12 pins - frame 315 - 355	12 pins - frame 315 - 355	12 pins - frame 315 - 355



ATTENTION

E1 - E3 / 4 - Reference voltage for the voltage regulator (see manual of voltage regulator).

For the single-phase triangle connection, the reference terminals of the regulator (E1 and E3 / 4) connected originally to the cables 7 and 9 on the auxiliary coil cable (4) which is connected to terminal 9, must be removed from the original position and reconnected as follows: \cables 4 and E3 / 4 on the main cable 8 and cable E1 in main cable 1 (as diagrams above).

4.8.2.4 Electrical connections of the voltage regulator

- To perform correctly the electrical connections of the alternator with the voltage regulator, refer to the manual of the voltage regulator.
- The voltage regulator model used depends on the characteristics of the alternator and the desired application, thus, the electrical connections with the alternator and the identification of the terminals may differ from one model to another.
- The manual of the voltage regulator is provided with the alternator.
- The default alternator model of line G is the GTA (with auxiliary coil and without auxiliary exciter).
- It is not recommended that the alternator work without GTA auxiliary coil, because with this configuration the power supply of the voltage regulator is impaired in cases of short circuit or overload. This condition is allowed only in emergency cases when there is failure of the auxiliary coil. As soon as possible, the alternator must be repaired to maintain the original characteristics.
- The generators with auxiliary exciter (model GPA) are special and should be manufactured in consultation with WEG.
- When using a transformer to adjust the reference voltage of the voltage regulator, the transformer cannot be installed inside the terminal box of the main alternator.



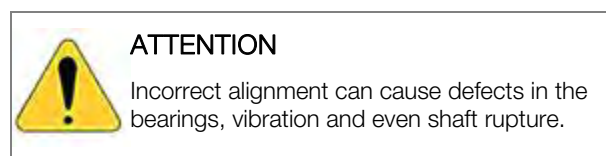
4.9 MECHANICAL FEATURES

4.9.1 Bases and foundations

- The dimensioning of the base should be performed so as to confer rigidity to the structure, avoiding amplification of the vibration levels of the set. The base should have a flat surface against the feet of the alternator in order to prevent deformations in its frame.
- The base should always be leveled from the ground (floor). The leveling is achieved by placing backstops between the base and the floor.

4.9.2 Alignment and leveling

The alternator must be perfectly aligned with the driving machine, especially in cases of direct coupling.



4.9.2.1 Alternators with double bearing (B35T or B3T)

The alternator must be correctly aligned with the driving machine particularly in cases of direct coupling. Incorrect alignment can cause defects in the bearings, vibration and even shaft rupture.

The alignment must be carried out according to the recommendations of the coupling manufacturer.

It is necessary to make the parallel and angular alignment of the alternator, as shown in Figure 4.6 and Figure 4.7.

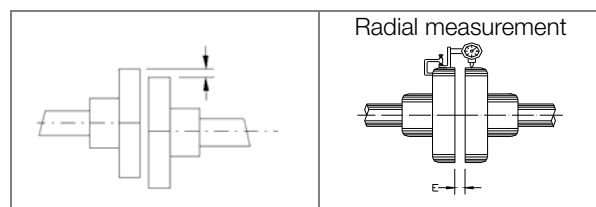


Figure 4.1 – Parallel alignment

Figure 4.6 shows the parallel misalignment of two shaft ends and practical means of suitable measurement using dial gauges.

The measurement is made in four points at 90° with the two half-couplings rotating together in order to eliminate the effects due to the support surface irregularities of the tip of the dial gauge. Choosing the upper vertical point 0°, half the difference of the measurement of the dial gauge in points 0° and 180° represents the vertical coaxial error. This should be suitably adjusted by adding or removing assembly backstops. Half the difference of the measurement of the dial gauge in points 90° and 270° represents the horizontal coaxial error.

This way we get an indication of when it is necessary to raise or lower the alternator or move it to the right or left on the activated side to clear the coaxial error.

Half of the maximum difference of the measurement of the dial gauge in a full rotation represents the maximum eccentricity.

The maximum permitted eccentricity for rigid or semi-flexible coupling is 0.03 mm.

Where flexible couplings are used, higher values than those given above are acceptable, but must not exceed the value given by the coupling manufacturer. It is recommended to keep a safety margin in these values.

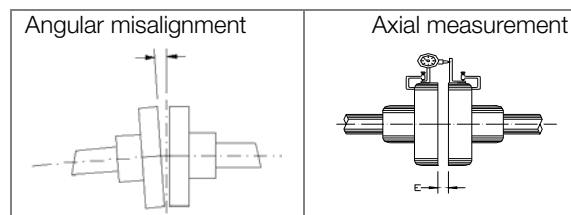


Figure 4.2 – Angular alignment

Figure 4.7 shows the angular misalignment and the practical way of measuring

The measurement is made in four points at 90° with the two half-couplings rotating together in order to eliminate the effects due to irregularities of the support surface of the tip of the dial gauge. Choosing the upper vertical point 0°, half the difference of the measurement of the dial gauge in points 0° and 180° represents the vertical misalignment. This should be suitably adjusted by adding or removing assembly backstops.

Half the difference of the measurement of the dial gauge in points 90° and 270° represents the horizontal misalignment. This should be properly fixed with lateral / angular movement of the alternator.

Half of the maximum difference of the measurement of the dial gauge in a full rotation represents the maximum angular misalignment.

The maximum permitted misalignment for rigid or semi-flexible coupling is 0.03 mm.

When flexible couplings are used, higher values than those given above are acceptable, but must not exceed the value given by the coupling manufacturer.

It is recommended to keep a safety margin in these values.

In alignment / leveling, it is important to consider the effect of temperature and of the alternator and the driving machine. Different levels of expansion of the coupled machines can change the alignment / leveling during operation.

4.9.2.2 Alternators with single bearing (B15T)

The base should be flat, allowing for correct support of the alternator on it. Wherever possible, vibration isolators should be used (shock absorbers) + between the set alternator + base engine in order to minimize transmission of vibration. When it is not possible to use the insulators between set and base, it is necessary to use the insulator between base and ground. One of the two settings is recommended, otherwise there will be operation with high levels of vibration.

4.9.3 Coupling

4.9.3.1 Alternators with double bearing (B35T / B3T)

4.9.3.1.1 Direct coupling

Direct coupling is always preferable due to lower cost, less space, no slip (belt) and greater security against accidents. In case of transmission with respect



to speed, it is also common for direct coupling with a gearbox.



ATTENTION

Carefully align the shaft ends, using a flexible coupling whenever possible, leaving minimum clearance of 3 mm between the couplings.

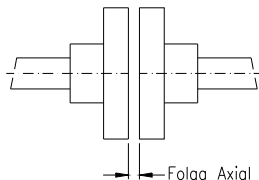


Figure 43 – Axial clearance

4.9.3.1.2 Coupling by pulleys and belts

When a speed ratio is required, the transmission belt is the most frequently used.

Avoid unnecessary radial efforts on the bearings, locating the shafts parallel to each other and pulleys perfectly aligned.

Belts that work laterally biased transmit alternating knocks to the rotor, and may damage the backs of the bearing. The slip of the belt can be avoided by applying a resinous material such as pitch, for example.

Belt tension should be just sufficient to prevent slipping during operation.



NOTE

Excessive tension in the belt increases stress on the shaft, causing vibration and fatigue and may even reach the fracture of the shaft.

The use of too small pulleys must be avoided; these cause bending of the alternator shaft due to the fact that the traction in the belt increases as the diameter of the pulley decreases.



ATTENTION

The double bearing alternators are made for applications with direct coupling. In applications with the use of pulleys and belts, WEG should be consulted to ensure a correct application of the alternator.



NOTE

Always use properly balanced pulleys. Avoid scraps of keys, as they represent an increase of the mass of unbalance. If these observations are not followed, there will be increased levels of vibration.

4.9.3.2 Alternator with single bearing (B15T)

4.9.3.2.1 Measure "G"

The alternators leave the factory mounted with discs and flanges according to customer request. Measure G is the distance between the outer face of the discs in relation to the flange face, as shown in Figure 4.9:



NOTE

The alternators leave the factory with the measure "G" as shown in Table 4.9. It is up to the assembler of the generator set the responsibility of verifying that the measure "G" is consistent with the diesel engine used. If measure "G" is not respected, this may result in serious damage to the alternator and the diesel engine or, in some cases it will not be possible to attach the alternator to the engine diesel.

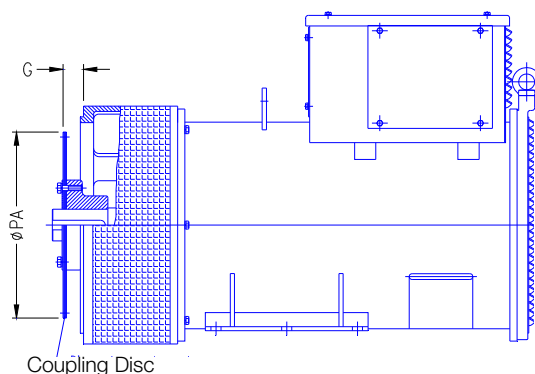


Figure 4.4 – Measure G

Table 4.1: Standard measures "G"

ØPA (mm)	Coupling Disc (SAE)	G (mm)
241,3	7,5	30,2
263,4	8	61,9
314,2	10	53,9
352,3	11,5	39,6
466,6	14	25,4
517,5	16	15,7
571,4	18	15,7
673,1	21	0,0
733,4	24	0,0

■ Measure ØPA has a tolerance of -0.13 mm

4.9.3.2.2 Change of measure G

If it is necessary to change the measure "G", the position of the coupling discs (E) should be amended. To do this simply remove or add the **spacer rings (I)**, as shown in Figure 4.10.



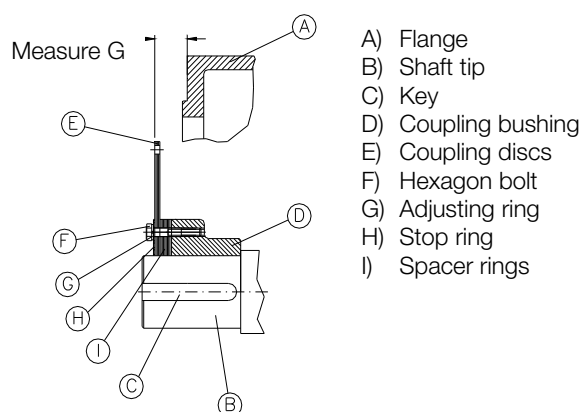


Figure 4.5 – Procedure to change measure G

**NOTE**

To meet the combination of necessary disc and flange, the flange can also be exchanged (A).

The fixation of the coupling disc must be performed according to tightening torques shown in Table 4.10

Table 4.2 - Tightening torques of the coupling discs

FRAME	FIXING SCREW (CLASS 10.9)	TIGHTENING TORQUE
160	6xM12x1,75	119 to 126
200	6xM12x1,75	119 to 126
250	10xM10x1,25	68 to 72
315	12xM12x1,5	119 to 126
355	12xM20x2,50	566 to 595
400	12xM20x2,50	566 to 595

- For larger frames, refer to WEG
- Secure the screws with high torque chemical glue

**NOTE**

The user is responsible for installing the alternator.
WEG is not responsible for damage to the alternator, associated equipment and installation, which occurred due to:

- Excessive vibrations transmitted;
- Poor facilities;
- Failures in alignment;
- Inappropriate storage conditions;
- Failure in following instructions before start-up;
- Incorrect electrical installation.



5 COMMISSIONING

- The alternator leaves the factory with a lock on the shaft or disc for better safety in transportation. Before putting it into operation, this lock must be removed.
- The connection of the terminals comply with the nominal characteristics of the alternator plate.
- To perform the adjustment of voltage and frequency, refer to the manual of the voltage regulator.

5.1 PRELIMINARY TEST

Before being given the initial start or after a long time without operation, check:

1. If the alternator is clean and the packaging materials and protective elements were removed from;
 2. If the connection parts of the coupling are in perfect condition and well greased and tightened where necessary;
 3. If the alternator is aligned;
 4. If the bearings are properly lubricated and in working condition;
 5. If the cables of the thermal protectors, grounding and of the heaters are connected. (if any);
 6. If the insulation resistance of the windings has the prescribed value;
 7. If all objects such as tools, measuring instruments and alignment devices were removed from the alternator work area;
 8. If the alternator is well fixed;
 9. If electrical connections are in accordance with the wiring diagram alternator;
 10. If the voltage regulator is properly connected and adjusted according to its installation manual;
 11. If the conductors of the network are properly connected to the main terminals as to prevent a short circuit or their release;
 12. If the alternator is properly grounded;
 13. Manually rotate the set in order to ascertain if there is no interference in the air-gap. Driven the alternator at no load, it must rotate slightly and without strange noises;
 14. If the air inlets and outlets are clear;
 15. If the measure "G" is in accordance with the specification for the diesel engine to be coupled (for single bearing alternators).
- a) Rotate the set and check for weird noises;
 - e) Activate the alternator to rated speed and check noise, vibration and check all protective devices; After following the procedures described above and resolved any problems that occurred (see anomalies / solutions) turn off the set.
 - f) With the alternator completely stopped, connect the voltage regulator (replace fuse), activate the set and make the necessary adjustments. The voltage regulator manual describes the procedures for available adjustments (stability, voltage, U/F).
 - g) Close the main circuit breaker and apply load and monitor current of the alternator making sure that it is within the specified.
 - h) Check the vibration and temperature monitoring of the set and measuring instruments (current, voltage and frequency). If there is significant variation in the vibration of the assembly between the initial condition and after thermal stability, it is necessary to reassess the alignment / leveling of the set.



ATTENTION

All measuring instruments and control should be under constant observation so that any changes in operation can be detected and remedied.

5.3 SHUTDOWN

- a) Before stopping the alternator, open the main circuit breaker to disconnect the load;
- b) If the alternator is equipped with space heaters, make sure that they remain energized while the switch remains stationary.



DANGER

Even after de-excitation, there is still voltage at the terminals of the machine, so only after the full stop of the equipment it is allowed to do any work.
Risk of death if not attending to that described above.

5.2 INITIAL OPERATION

In addition to following the safety instructions given in chapter 2.2 of this manual, to put the alternator into operation for the first time the following procedure must be adopted:

- a) Make sure that the alternator terminals are disconnected from the load by removing the fuse panel or circuit breaker or placement of the key in position "off";
- b) Turn off the space heaters of the alternator (if any), before putting it into operation;
- c) disconnect the voltage regulator (removing the fuse in series with the auxiliary coil);



ATTENTION

The U / F function of the regulator is factory set, but as additional security we recommend disconnecting the regulator.

5.4 ALTERNATORS IN PARALLEL

5.4.1 With each other and / or with the network

Minimum requirements for operation in parallel of the alternator, not including the drive machine control:

1. The alternator must have the same operating voltage of the other alternator or the network;
2. The voltage regulator must allow the operation of the alternator in parallel;



3. Add a parallel CT (In / 5) of 5-10 VA phase which is not used as a reference for the voltage regulator and make the electrical connection according to the manual of the voltage regulator.
 4. Having a panel suitable for protection and operation of the alternator in parallel.
 5. The timing and setting of the active power must be imposed by the speed control of primary machines.
- In case of high currents neutral appear, use a ground coil or open the neutral connection of one alternator. That happens especially when the alternators are not equal or when feeding loads with high harmonic content.



ATTENTION

This type of installation must be performed by technical staff.

For transient operations in parallel (e.g. loading ramp) in which the switch will operate in a simple way after a period in parallel, the parallel CT should be short-circuited, it is therefore unnecessary in this operation.



6 MAINTENANCE

Maintenance procedures should be followed to ensure the proper performance of equipment. The frequency of inspections will depend essentially on local conditions of application and conditions of service.

Failure to comply with one of the items listed below can mean a reduction in the life of the alternator, unnecessary stops and / or damage to facilities.

6.1 EMERGENCY GENERATOR SETS

The alternators used in emergency generators should, according to humidity degree of the site, receive load of 2 to 3 hours each month.

6.2 CLEANING

The frame, multi-leaf dampers and deflecting grids must be kept clean, without accumulation of oil or dust on the outside to facilitate heat exchange with the environment. Also inside the alternators must be kept clean and free of dust, debris and oil. To clean them, you should use brushes or clean cotton cloth. If dust is not abrasive, a jet of compressed air must be used blowing the dirt from the fan cover and eliminating any accumulation of dust contained in the fan blades and frame.

Debris impregnated with oil or moisture can be cleaned with cloth dipped in a suitable solvent.

The terminal box must have terminals clean, no rust, in perfect mechanical condition and without deposits of grease or verdigris.

6.3 NOISE

The noise must be observed at regular intervals 1-4 months. In case of anomaly the alternator must be stopped and the cause must be investigated and solved.

6.4 VIBRATION

Maximum vibration level for the on-load alternator: **20mm/s** (RMS).

6.5 BEARINGS

Temperature control in the bearing is also part of routine maintenance of the alternators. The elevated temperature must not exceed 60°C, measured in the outer ring of the bearing.

The temperature can be controlled permanently with thermometers placed outside the frame or thermal elements embedded (optional).

Temperature of alarm and shutdown for the bearings can be adjusted respectively to 110°C and 120°C.

6.5.1 Lubrication

Alternators with frame size up to 315 have shielded bearings, not being necessary to make the lubrication thereof. These should be replaced when they reach 20,000 hours of work or 30 months, whichever occurs first.

For the alternator with frame size 355 and higher, bearings should be relubricated **annually** or as lubrication intervals given in the table below, whichever occurs first:

Table 6.1 – Bearing data

Frame	Bearing	Bearing	Lubrication interval (hours of operation)	Grease amount (g)
160	DE	6211 2RS	-	-
	NDE	6209 2RS	-	-
200	DE	6313 2RS	-	-
	NDE	6210 2RS	-	-
250	DE	6318 2RS-C3	-	-
	NDE	6214 2RS	-	-
315	DE	6320 2RS-C3	-	-
	NDE	6316 2RS-C3	-	-
355	DE	6322-C3	4.500	60
	NDE	6220-C3	4.500	31
400	DE	6324-C3	4.500	72
	NDE	6226-C3	4.500	46

1) The estimated useful life for regreasable bearings is **40,000** hours

- For other frames, refer to WEG.
- **DE = Drive end**
- **NDE = No Drive End**

6.5.1.1 Type and amount of grease

The relubrication of the bearings should always be made with **original grease**, specified on the nameplate and in the documentation of the bearings of the alternator. The WEG G Line alternators are provided with grease POLIREX EM 103.



ATTENTION

1. WEG does not recommend the use of any grease different from the original grease of the alternator.
2. When the bearing is opened inject the fresh grease through the grease nipple to eject the old grease found in grease inlet tube and applying new grease to the bearing, the inner ring and outer ring by completing three quarters of the voids.
3. Never clean the bearing with a cotton cloth as it may release lint serving as a solid particle.
4. Proper lubrication is important, that is, the grease applied correctly and in a suitable quantity, for both a poor lubrication as lubrication excessive bring the bearing adverse effects.
5. Excessive lubrication entails temperature rise due to the large resistance offered to the movement of rotating parts and, mainly, due to beating of grease, which ultimately completely loses its characteristics of lubrication.



**NOTE**

WEG is not responsible for the change of grease or for any damages arising from the change.

6.5.1.2 Instructions for lubrication

The lubrication system is designed such that during relubrication of bearings, all of the old grease is removed of bearings and expelled through a tube which enables the output of the same, but prevents the entry of dust or other hazardous contaminants into the bearing.

This drain also prevents damage to the bearings due to the well known problem of excessive relubrication.

It is advisable to perform relubrication with the alternator in operation, so as to ensure the renewal of grease in the bearing housing.

If this is not possible due to the presence of parts near the grease nipple (pulleys etc.), which can jeopardize the physical integrity of the operator, proceed as follows:

- With the alternator stopped inject approximately half the total amount of grease planned and operate the alternator for approximately 1 minute at full speed;
- Stop the alternator and inject the remaining grease. Injection of all grease with the alternator stopped can cause penetration of the lubricant to the inside of the alternator.

**ATTENTION**

It is important to clean the grease cups prior to lubrication, to prevent foreign material from being drawn into the bearing.

**NOTE**

The data of bearings, quantity and type of grease and lubrication intervals are reported in an identification plate fixed on the alternator. Verify this information before making lubrication.

- The lubrication intervals informed in the plate consider a working temperature of the bearing of 70°C.
- Based on the operating temperature ranges listed below, apply the following correction factors for lubrication intervals of bearings:
 - Operation temperature lower than 60°C: 1,59
 - Operation temperature from 70°C to 80°C: 0,63
 - Operation temperature from 80°C to 90°C: 0,40
 - Operation temperature from 90°C to 100°C: 0,25
 - Operation temperature from 100°C to 110°C: 0,16

6.5.1.3 Procedures for relubrication of bearings

1. Remove the cover of the drain;
2. Clean with a cotton cloth around the grease cup hole;
3. With the alternator running, inject grease until new grease begins to flow from the drain or until the amount of grease informed in Table 6.1 has been introduced;
4. Operate the alternator long enough so that excess grease flow through the drain;
5. Inspect the bearing temperature to make sure that there was no significant change;
6. Replace the cover of the drain.

6.5.2 Exchange of Bearings**ATTENTION**

For security, the exchange of bearings must be done with the alternator disconnected from the driving machine.

6.5.2.1 Alternator with single bearing - B15T**Frame 160 and 200**

1. Put the alternator in a vertical position with the side of the coupling discs to the top;
2. Remove the whole rotor, preferably with an eyebolt having the same thread of the center hole of the shaft end, increasing it with the use of a hoist;
3. Replace the bearing and replace the complete rotor, making sure that the O-ring is in position at the hub of the back cover.

Frame 250

1. Release the cables of the exciter (F+) e (F-).
2. Remove the cover and multi-leaf damper to access the rear bearing and perform the exchange.

Frames 315 and 400

To disassemble the rear of the alternator and have access to the bearing, follow the instructions below:

1. Release cables (F+) and (F-) in the terminal box;
2. Remove back multi-leaf damper;
3. Remove the cables of the main rotor connected to the rectifier bridge of the exciter rotor;
4. Remove the screws that hold the exciter rotor shaft and remove it manually;
5. Remove the screws of the back cover attached to the frame and remove this cover along with the exciter stator;
6. Replace the bearing and assemble the alternator.

6.5.2.2 Alternator with double bearing - B35T

To perform the exchange of the bearings in the alternator with double bearing, it is necessary to disassemble the alternator entirely.

6.5.2.3 Replacement of the bearing

Disassembly of bearings should always be made with the use of appropriate tools (bearing puller).

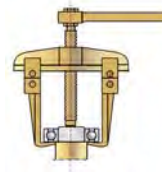


Figure 6.1 – Device to withdraw bearings

**ATTENTION**

A bearing should only be removed from the shaft when absolutely necessary

Instructions:

1. The extractor grabs must be applied on the side of the bearing inner ring to be disassembled or on an adjacent part.
2. Before installation of new bearings, the shaft seats should be cleaned and lightly lubricated.



- The bearings must be heated to a temperature between 50° C and 100° C to facilitate assembly.
- The bearings should not be subjected to shock, drops, storage with vibration or humidity, which can cause marks on the internal races or in the balls, reducing their life.

6.6 MAINTENANCE OF THE EXCITER

6.6.1 Exciter

For the proper performance of its components, the exciter alternator should be kept clean.

Check the insulation resistance of the windings of the exciter main and of the auxiliary exciter (if any) periodically to determine the insulation condition of the same by following the procedures described herein.

6.6.2 Test on the diodes

Diodes are components that have great durability and do not require frequent tests. If the alternator indicating a defect presents failure in the diode or an increase in field current for the same load condition, then the diodes should be tested in accordance with the following procedure:

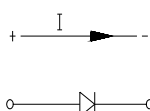
- Release the connections of all the diodes with the rotor winding of the exciter;
- With an ohmmeter, measure the resistance of each diode in both directions.



NOTE

When testing diodes, observe the polarity of the test terminals in regard to polarity of the diode.

The polarity of the diode is indicated by an arrow on its frame.



The current conduction must occur only in the anode-cathode direction, i.e. in the condition of direct polarization.

The diode is considered good when presenting low ohmic resistance (up to approximately 100Ω) in its forward direction and high resistance (approx. 1MΩ) in opposite direction. Defective diodes have ohmic resistance 0Ω or greater than 1MΩ action in both measured directions. In most cases, the method with ohmmeter to test the diodes is sufficient to identify faults in the diodes. However, in some extreme cases it may be necessary to apply the rated voltage of blocking and / or current flow for detecting fault in the diodes. Due to the efforts required for these tests, in case of doubt, it is recommended to perform the exchange of the diodes.

6.6.3 Replacement of the diodes

To access the diodes and perform the exchange, it is necessary to:

- Disassemble the alternator (frame 160);
- Remove the back inspection cover (frame 200);
- Remove the back multi-leaf damper (frames 250 to 400);

- For other frames, refer to WEG.

To replace the diodes, proceed as follows:

- Undo the connection of the 6 diodes to the exciter rotor;
- Release support for diodes of the exciter rotor and remove it;
- Secure the support in a bench lathe with protection on the jaw, and remove all diodes;
- Install three new diodes of the same polarity (AND or CTD) in one of two connection bridges;
- Install the other connecting bridge, three new diodes of polarity opposite of the three diodes previously installed;
- Secure all diodes, tightening them with a torque wrench respecting the tightening torques in Table 6.2;
- Secure the set of diodes in the exciter rotor;
- Make the connections of the diodes with the exciter rotor winding.



ATTENTION

It is essential that the tightening torques indicated are respected so that the diodes are not damaged in the assembly.

Table 6.2 – Tightening torque of the diodes

Diode base thread (mm)	Torque key of torquimeter (mm)	Tightening torque (mm)
M6	11	2
M8	17	4
M12	24	10
M16	32	30

Table 6.3 – Table of used diodes

Frame	WEG designation		Commercial designations
			Semikron
160	DS4	AND	SKN26/12
		CTD	SKR26/12
200 - 315	DS6	AND	SKN50/12
		CTD	SKR50/12
355 - 450	DS8	AND	SKN71/12
		CTD	SKR71/12

For other frames, refer to WEG.

6.6.4 Test on varistor

The varistor is the device installed between the two bridges connecting the diodes and has the purpose of protecting diodes against overvoltage.

To test the conditions of operation of the varistor an ohmmeter can be used.

The resistance of a varistor must be very high (± 20,000 ohms).

In case of damages verified in the varistor or if its resistance is very low, it must be replaced.

6.6.5 Replacement of the varistor

To replace the varistor, WEG recommends that the following recommendations be observed:

- Replace the damaged varistor by a new identical to the original, as reported in Table 4.7;
- To replace the varistor, loosen the screws that secure the bridges connecting the diodes;



3. When removing the varistor, observe carefully how the components were mounted so that new varistor is installed the same way;
4. Before mounting the new varistor, make sure that all contact surfaces of the components are clean, leveled and smooth so as to ensure a perfect contact between them;
5. Attach the new varistor tightening the screws that hold the connecting bridges just enough to make a good electrical connection, watch the filling with silicone in the compartment of the new capacitor.

6.6.6 Test on the capacitor

The capacitor is the device installed between the two bridges connecting the diodes and has the purpose of protecting diodes against voltage surge.

To test the operating conditions of the capacitor a multimeter can be used with the function of measuring capacitance.

The capacitance measurement should be according to the specification for the component;

In case of damages verified in the capacitor or if capacitance is above the specified tolerance, it must be replaced.

6.6.7 Replacement of the capacitor

To replace the capacitor, WEG recommends that the following recommendations be observed:

1. Replace the damaged capacitor by a new identical to the original, as reported in Table 4.7;
2. To replace the capacitor, loosen the screws that secure the bridges connecting the diodes;
3. When removing the capacitor, observe carefully how the components were mounted so that new capacitor is installed the same way;
4. Before mounting the new capacitor, make sure that the connection terminals and screws are clean, ensuring a perfect contact between them.
5. Fix the capacitor again tightening the terminals that attach to connecting bridges, just enough to make a good electrical connection. Observe the filling with silicone in the compartment of the new capacitor.

6.7 AIR FLOW

The air inlets and outlets of the alternator should be kept clear, so that heat exchange is efficient. If there is deficiency in heat exchange, the alternator will overheat and damage the winding (burning of the alternator).

6.8 COMPLETE INSPECTION

The frequency of inspections should be defined according to the environment where the alternator is installed. The more aggressive the environment (dirt, oil, salt spray, dust, etc.) the smaller should be the time interval between inspections, as follows:

- Clean the dirty windings with a brush;
- Use a cloth dampened in a suitable solvent to remove grease, oil and other impurities from the winding;
- Dry with dry air;
- Blow compressed air through the ducts in the stator plate package, the rotor and bearings.



NOTE

Compressed air should always be blown after cleaning, never before.

- Drain condensed water;
- Clean inside the terminal boxes;
- Measure insulation resistance;

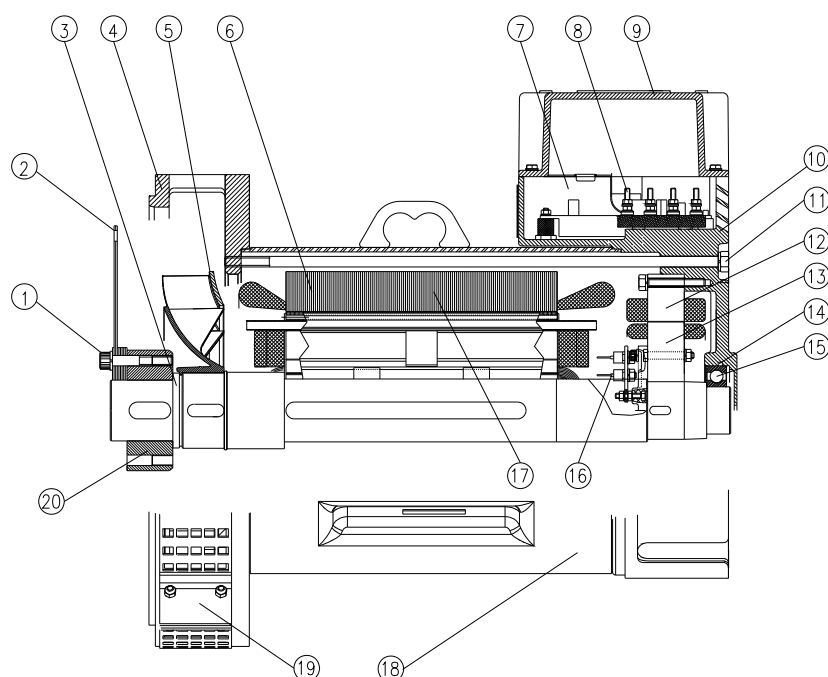


ATTENTION

The absence of complete inspections in the alternator will cause the accumulation of dirt inside. The operation under these conditions may reduce the life of the machine and cause unwanted downtime and additional costs for the recovery of the equipment.



6.9 DISASSEMBLY, ASSEMBLY AND LIST OF PARTS - GTA160



1. Fixing screw of the discs
2. Coupling discs
3. Shaft
4. Flange B15
5. Fan
6. Main stator
7. Voltage regulator
8. Terminal block
9. Terminal box cover
10. Integrated terminal box and back cover
11. Fixing rod
12. Exciter stator
13. Exciter rotor
14. O'ring
15. Back bearing
16. Diodes
17. Main rotor
18. Frame
19. Protection screen
20. Coupling bushing

Disassembly

1. To disassemble the alternator, place it in the vertical position with the side of the coupling discs upwards;
2. Remove the coupling discs;
3. Remove the whole rotor by using an eyebolt with the same thread as that of the center hole of the shaft end, lifting it with the aid of a hoist;
4. Mark the position of the flange (4) and of the ND-endshield (10) in relation to the frame (18). Thus, the original and optimal alignment between these three parts will be guaranteed;
5. Place the alternator in the horizontal position on a base so that the feet and flange will be suspended; loosen the main connection cables of the terminal block and the cables of the voltage regulator (7);
6. Remove the pull rods (11) that fix the ND-endshield and the DE-flange to the frame. **When removing the pull rods, the ND-endshield and the flange will be loose and may fall;**
7. Using a rubber hammer, remove the ND-endshield making sure that all cables of the terminal box are released, thus, preventing.



NOTE

To disassemble the alternators with double bearing (constructive form B35T) first the flange and the D-endshield must be removed.

Assembly

1. Check if machined parts of the frame and of the flange and ND-endshield are clean and with corrosion protection;
2. With the frame placed horizontally on a flat surface, align the marking of the ND-endshield and of the front flange to the marking of the frame and fit them, taking appropriate care with the cables of the main stator and of the of the exciter stator to avoid damaging them;
3. Fix the flange and ND-endshield to the corresponding pull rods (11);
4. Put the alternator in a vertical position with the flange side up;
5. Insert the complete rotor within the frame, taking appropriate care not to damage the coils of the exciter rotor and of the main rotor;
6. Put the alternator in horizontal position;
7. Make sure that the bearing is fitted on the seat and the o'ring (14) is in the correct position;
8. Make the cable connections of the voltage regulator and exciter according to the alternator wiring diagram and the voltage regulator manual;
9. Make sure that all connections of main cables, voltage regulator and exciter are correct.

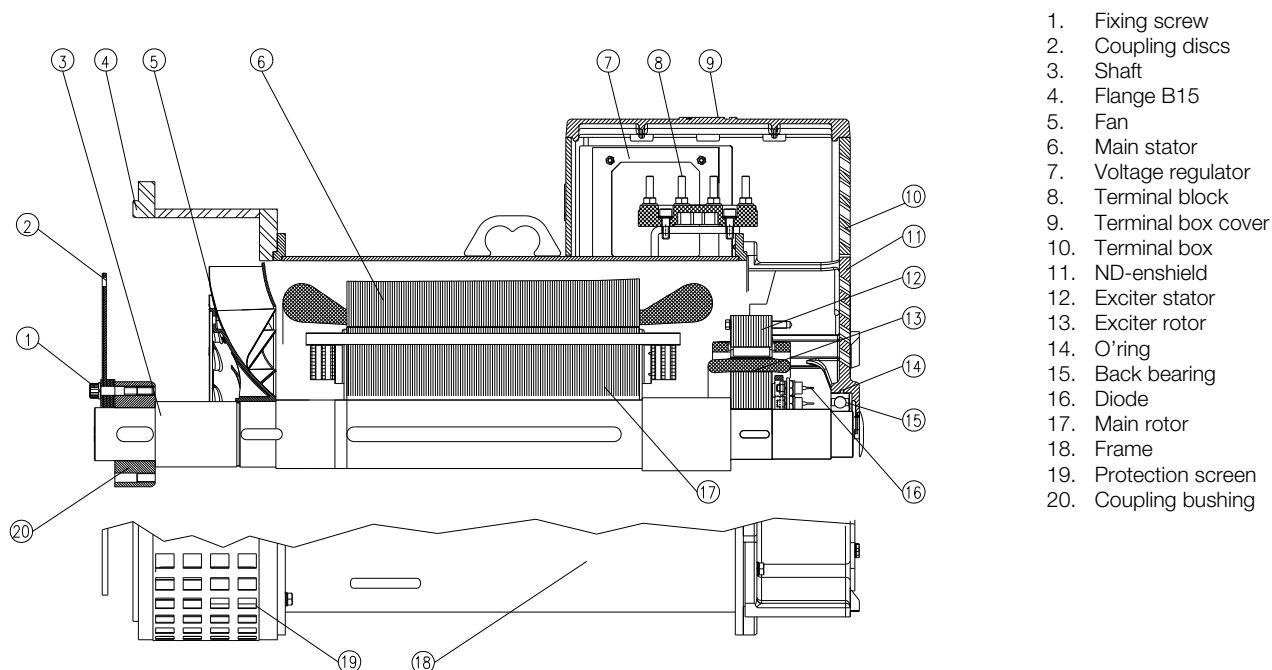


NOTE

- During assembly, the pull rods must be perfectly aligned for a correct alignment of the parts fixed.
- To assemble the alternators with double bearing (constructive form B35T) the flange and the D-endshield must also be mounted.



6.10 DISASSEMBLY, ASSEMBLY AND LIST OF PARTS - GTA200



1. Fixing screw
2. Coupling discs
3. Shaft
4. Flange B15
5. Fan
6. Main stator
7. Voltage regulator
8. Terminal block
9. Terminal box cover
10. Terminal box
11. ND-enshield
12. Exciter stator
13. Exciter rotor
14. O'ring
15. Back bearing
16. Diode
17. Main rotor
18. Frame
19. Protection screen
20. Coupling bushing

Disassembly

1. To disassemble the alternator, put the alternator in a vertical position with the side of the coupling discs to the top;
2. Remove the coupling discs (2);
3. Remove the whole rotor by using an eyebolt with the same thread as that of the center hole of the shaft end, lifting it with a hoist;
4. Mark the position of the ND-enshield (11) in relation to the frame (18). So the original alignment and optimal between these parts will be guaranteed;
5. Place the alternator in the horizontal position on a base so that the feet and flange will be suspended;
6. Remove the cover of the terminal box (9), remove the cables connecting the main terminal block (8), cables of the voltage regulator (7) and of the exciter (12);
7. Loosen the screws that fasten the terminal box (10) to the ND-enshield (11) and remove it;
8. Remove the screws that hold the ND-enshield to the frame;
9. Using a rubber hammer, remove the ND-enshield making sure that all connecting cables are released, thus, preventing them from being damaged; Likewise, if necessary, remove the front flange (4).



NOTE

To disassemble the alternators with double bearing (constructive form B35T) first the flange and the D-enshield must be removed.

Assembly

1. Check if machined parts of the frame and of the flange and ND-enshield are clean and with corrosion protection;
2. With the frame placed horizontally on a flat surface, align the marking of the ND-enshield and of the front flange to the marking of the frame and fit them, taking appropriate care with the cables of the main stator and of the of the exciter stator to avoid damaging them ;
3. Attach the ND-enshield with the corresponding fixing screws;
4. Fix the terminal box on the ND-enshield;
5. Put the alternator in a vertical position with the flange side up;
6. Insert the complete rotor within the frame, taking appropriate care not to damage the coils of the exciter rotor and of the main rotor;
7. Put the alternator in horizontal position;
8. Make sure that the bearing is fitted on the seat and the o'ring (14) is in the correct position;
9. Make the cable connections of the voltage regulator and exciter according to the alternator wiring diagram and the voltage regulator manual.
10. Make sure that all connections of main cables, voltage regulator and exciter are correct.

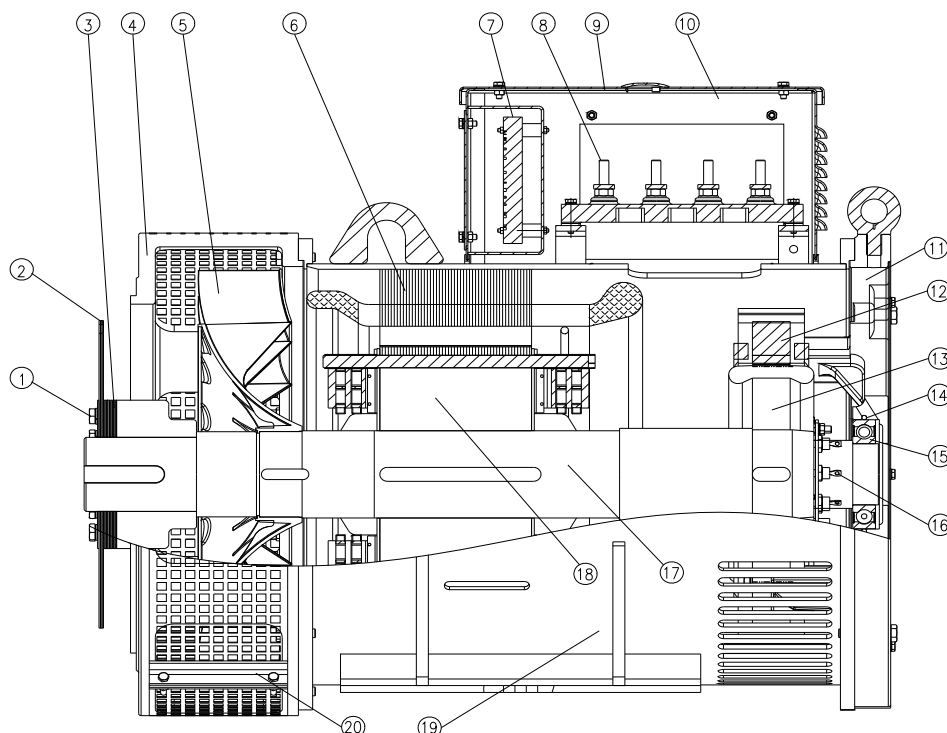


NOTE

To assemble the alternators with double bearing (constructive form B35T) the flange and the D-enshield must also be mounted.



6.11 DISASSEMBLY, ASSEMBLY AND LIST OF PARTS - GTA250



1. Fixing screw
2. Coupling discs
3. Coupling bushing
4. D-enshield
5. Fan
6. Main stator
7. Voltage regulator
8. Terminal block
9. Terminal box cover
10. Terminal box
11. ND-enshield
12. Exciter stator
13. Exciter rotor
14. O'ring
15. Back bearing
16. Diode
17. Shaft
18. Main rotor
19. Frame
20. Protection screen

Disassembly

1. Open the cover of the terminal box (9) and disconnect the cables from the voltage regulator and of the exciter;
2. Loosen the screws securing the terminal box (10) to the frame (19) and remove it;
3. Remove the protection screen (20);
4. Loosen the screws holding the front flange (4) to the frame and remove it;
5. Remove the clamps and thread to release the cables from the main stator and exciter;
6. Loosen the screws that secure the ND-enshield (11) to the frame and remove it using a rubber hammer;
7. The removal of the whole rotor must be done by the front of the alternator, using an appropriate device.



NOTE

To disassemble the alternators with double bearing (constructive form B35T) first the flange and the D-enshield must be removed.

Assembly

1. Check if machined parts of the frame and of the flange and ND-enshield are clean and with corrosion protection;
2. Insert the main rotor at the front with an appropriate device;
3. Check if the o'ring (14) is correctly placed in the bearing seat of the ND-enshield;
4. Fit the ND-enshield (11) in the bearing and fix it;
5. Place the terminal box into position and secure it with the appropriate screws;
6. Make the cable connections of the voltage regulator and exciter according to the alternator wiring diagram and the voltage regulator manual.

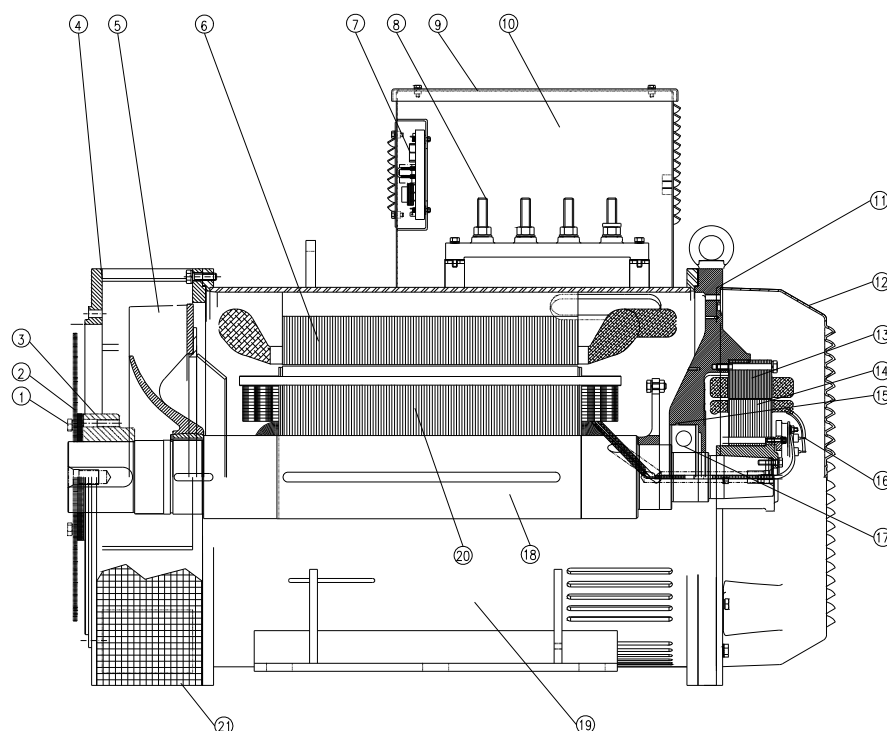


NOTE

To assemble the alternators with double bearing (constructive form B35T) the flange and the D-enshield must also be mounted.



6.12 DISASSEMBLY, ASSEMBLY AND LIST OF PARTS - GTA315 to GTA400



1. Fixing screw
2. Coupling discs
3. Coupling bushing
4. Flange B15
5. Fan
6. Main stator
7. Voltage regulator
8. Terminal block
9. Terminal box cover
10. Terminal box
11. ND-enshield
12. Fan cover
13. Exciter stator
14. Exciter rotor
15. O'ring
16. Diode
17. Back bearing
18. Shaft
19. Frame
20. Main rotor
21. Protection screen

Disassembly

1. Open the cover of the terminal box (9) and disconnect the cables from the voltage regulator and of the exciter;
2. Loosen the screws securing the terminal box (10) to the frame (19) and remove it;
3. Remove the protection screen (21);
4. Loosen the screws holding the front flange (4) to the frame and remove it;
5. Remove the clamps and thread to release the cables from the main stator and exciter;
6. Loosen the screws and remove the back fan cover (12);
7. Loosen the screws that hold the stator of the exciter (13) on the ND-enshield and remove it using a rubber hammer and taking due care to avoid accidents or damage to the coils of the stator and exciter rotor;
8. Remove the exciter rotor, according to the procedure described in Section 6.13;
9. Remove the screws that secure the ND-enshield (11) on the frame and remove it with a lever and a rubber hammer;
10. The removal of the whole rotor must be done by the front of the alternator, using an appropriate device.



NOTE

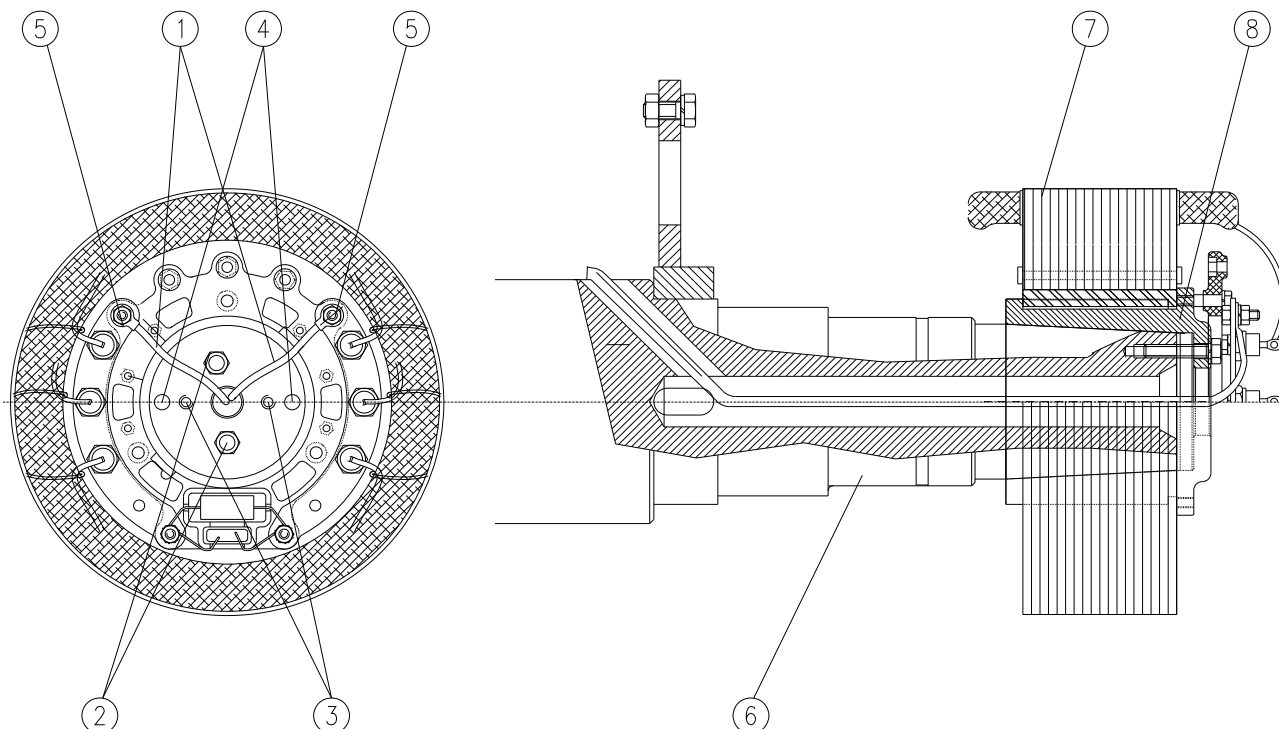
- To disassemble the alternators with double bearing (constructive form B35T) first the flange and the D-enshield must be removed.
- Before disassembling the closed alternators type GTF the heat exchanger installed at the top of the alternator must be removed.

Assembly

1. Check if machined parts of the frame, flange, ND-enshield and fan cover are clean and with corrosion protection;
2. Insert the main rotor at the front with an appropriate device;
3. Check if the o'ring (15) is correctly placed in the bearing seat of the ND-enshield;
4. Fit the ND-enshield (11) in the bearing and fix it;
5. Manually fit the exciter rotor shaft and secure it with appropriate screws;
6. Connect the cables of the main rotor to the rectifier bridge of the exciter rotor;
7. Fix the exciter stator (13) on the DN-enshield using the appropriate screws;
8. Make sure that the connecting cables of the exciter stator are positioned correctly in order to make the connection in the terminal box;
9. Attach the back fan cover (12) on the DN-enshield;
10. Attach the front flange (4) to the frame;
11. Place the protection screen (21);
12. Place the terminal box (10) in proper position and attach it in the frame;
13. Make the cable connections of the voltage regulator and exciter according to the alternator wiring diagram and the voltage regulator manual.
14. Attach the cover to the terminal box (9).



6.13 DISASSEMBLY OF THE EXCITER ROTOR GTA315 to GTA400



Procedure for withdrawing the exciter rotor

1. Remove the screws (5) that secure the connection cables of the rotor (1) the wheel of diodes and release the cables;
2. Remove the mechanical lock "half moon" of the fixing screws (2);
3. Remove the fixing screws (2) of the exciter rotor;
4. Place the two screws (2) in threaded holes (3) and tighten the two screws evenly "simultaneously" in order to force the fixing bushing (8) come off the shaft (6) until the bushing (8) along with the exciter rotor (7) is detached and can be removed by hand.

6.14 MAINTENANCE PLAN

Verifications and maintenance tasks to perform	Daily	Every 250 h	Every 1500 h	Every 4500 h
Observe any strange noise with the alternator in movement	x			
Inspect ventilation (air flow)	x			
Check insulation resistance		x		
Check and retighten the screws and connection terminals		x		
Check vibration and noise levels		x		
Inspect bearings		x		
Inspect connections of voltage regulator		x		
Clean the alternator inside and outside			x	
Inspect the connections and accessories operation			x	
Inspect diodes			x	
Inspect varistors (if any)			x	
Lubricate bearings ¹				
Replace bearings ²				
Complete verification of the alternator				x

1. Check the lubrication interval and amount of grease in section 6.5.1 of this manual.

2. The exchange of bearings should be performed every 20,000 hours.



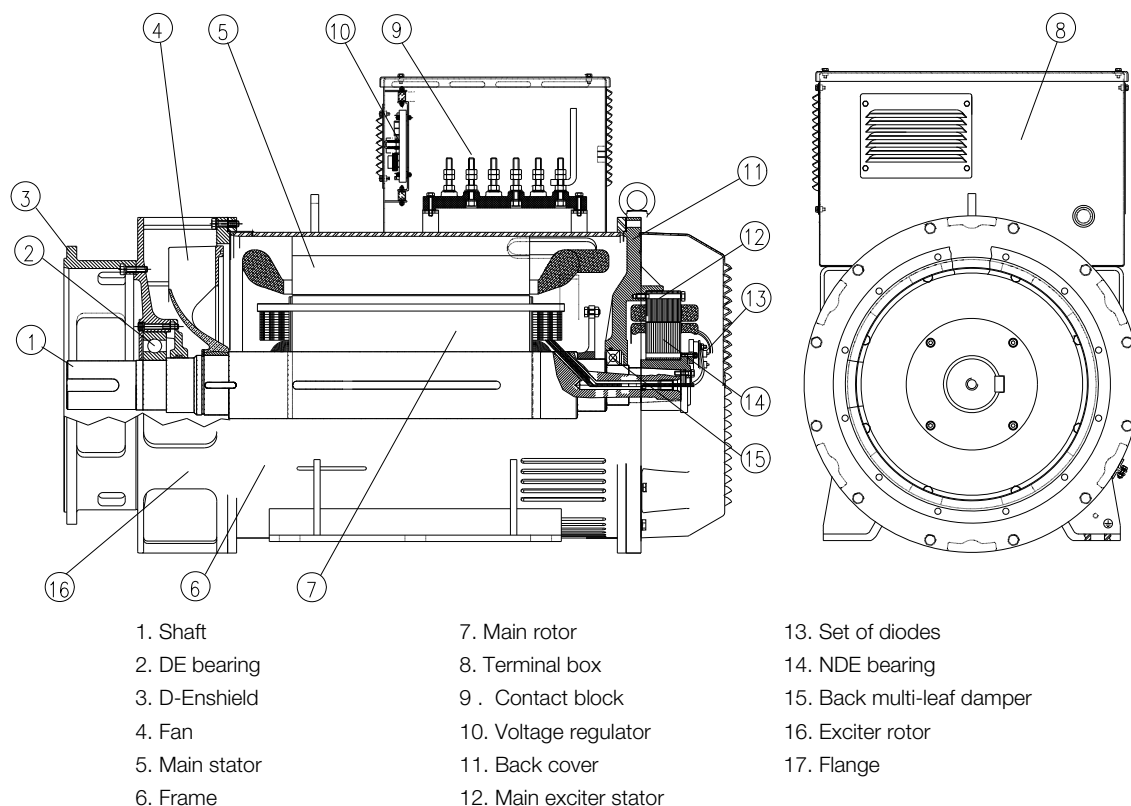
NOTE

The verifications and tasks described in the table above must be performed according to item 6 of this manual.

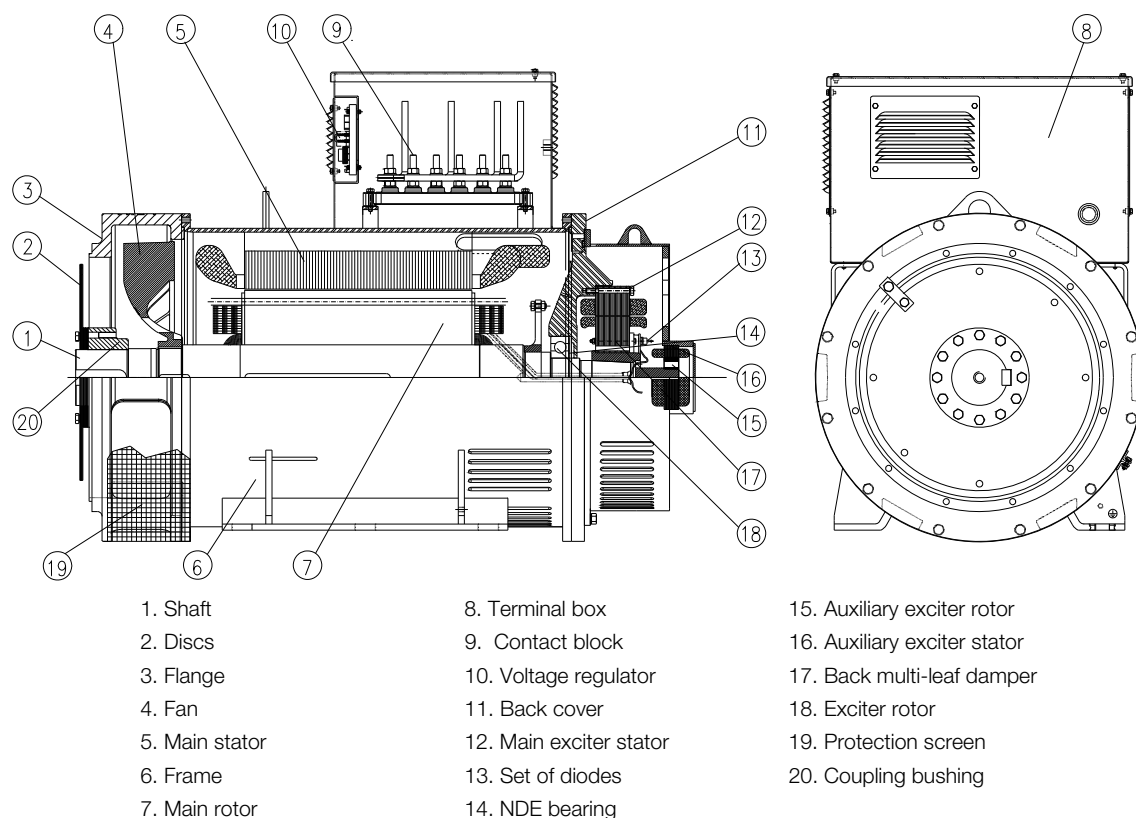


7 OF PARTS (SPECIAL MODELS)

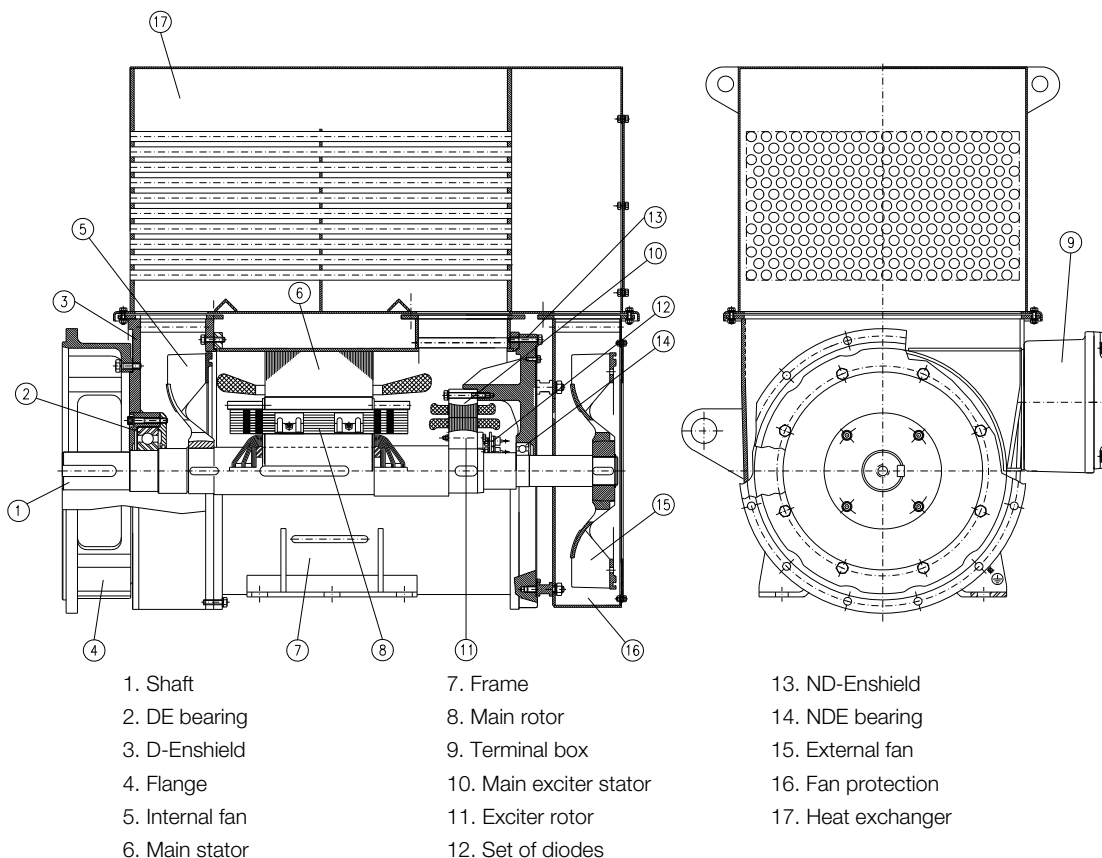
7.1 GTA DOUBLE BEARING (B35T)



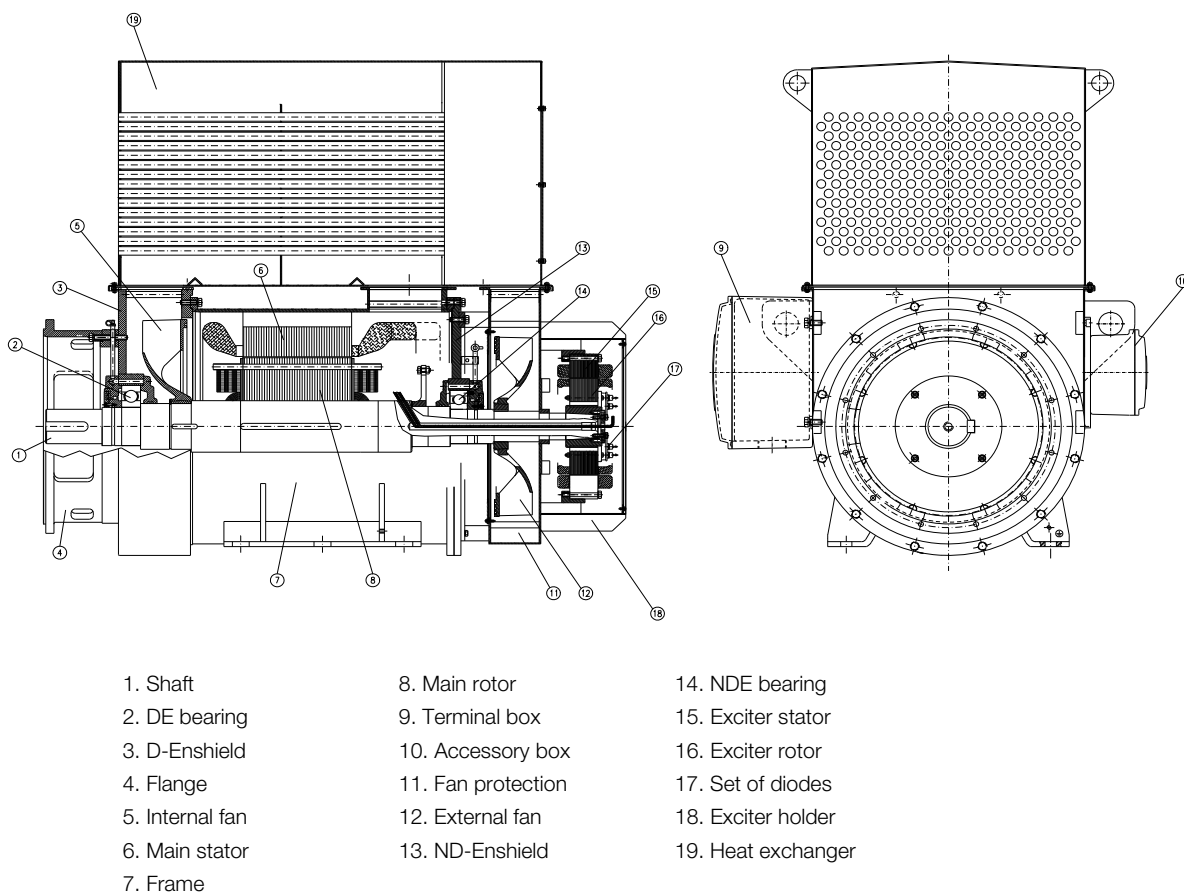
7.2 GPA SINGLE BEARING (B15T)



7.3 GTF 200 AND GTF250



7.4 GTF315 to GTF560



8 TROUBLESHOOTING

Below are listed some abnormal situations that can occur on the switch in service, as well as the correct procedure for verification and correction.

THE ALTERNATOR DOES NOT EXCITE	
ANOMALY	PROCEDURE
Interruption in the auxiliary winding circuit.	Check the union of the cables of the auxiliary winding in the connection block extending to the connecting block the regulator and fuse.
Burned fuse.	Replace the fuse (as specified).
Residual voltage too low.	Disconnect the wires to the regulator and perform external excitation with battery 12 to 20Vcc (negative pole in F- and positive pole in F+), until the beginning of the excitation process. The starting battery of the diesel engine should not be grounded.
Drive speed is not correct.	Measure the speed and regulate it
Interruption in the main excitation circuit.	Check the continuity of the cables F- and F+, make measurements in all the diodes and replace defective diodes or replace the whole set.
Relay or other component of the voltage regulator faulty.	Replace voltage regulator.
External potentiometer for voltage adjustment ruptured or interrupted connection.	Check the connections to terminals 11-12 and potentiometer.
Varistor of protection of the diodes (if any) is faulty.	If defective, the varistor should be replaced, or there is no a spare part, remove it temporarily.

ALTERNATOR DOES NOT EXCITE, UP TO RATED VOLTAGE	
ANOMALY	PROCEDURE
Faulty rotating diodes.	Replace the set of diodes.
Incorrect speed.	Measure the speed of the primary machine and regulate it.
Adjustment below the rated voltage.	Adjust the potentiometer in the regulator or the external one.
Supply of voltage regulator is not according to the desired output voltage.	Verify if connections are according to the manual of voltage regulator.

IN NO LOAD, THE ALTERNATOR EXCITES UP TO RATED VOLTAGE, BUT COLLAPSES WITH THE LOAD	
ANOMALY	PROCEDURE
Sharp speed decrease.	Control Diesel selector.
Faulty rotating diodes.	Replace the set of diodes.



THE ALTERNATOR, IN NO LOAD, IS EXCITED THROUGH OVERVOLTAGE.

ANOMALY	PROCEDURE
Faulty voltage thiristor of regulator.	▪ Replace regulator.
Power transformer of regulator is defective or incorrect.	▪ Check voltage / operation ratio.
Supply of voltage regulator is not according to the desired output voltage.	▪ Redo the connections. Check the manual of the voltage regulator.

OSCILLATION ON ALTERNATOR VOLTAGE

ANOMALY	PROCEDURE
Stability improperly set	▪ Adjust the stability of the regulator with the trimpot.
Oscillations in the speed of the drive machine.	▪ Frequent oscillations are originating from the drive machine and need to be eliminated.

MECHANICAL ANOMALIES

ANOMALY	PROCEDURE
Overheating of bearings.	▪ Faulty bearing, lack of lubrication or excessive axial clearance.
Overheating in the alternator frame.	▪ Air input or output partially clogged or hot air is returning to the alternator, alternator overload or over excitement.
Excessive vibration.	▪ Misalignment, faulty assembly or clearance in coupling.
Strong voltage drop with subsequent recovery: (flashes)	▪ Incorrect adjustment of stability, alternator operating with simple parallelism system turned on or momentary overload.



ATTENTION

The machines included in this manual are in continuous improvement, so the information in this manual is subject to changes without notice.



9 WARRANTY

These products, when operated under the conditions stipulated by WEG in the operating manual for such product, are warranted against defects in workmanship and materials for twelve (12) months from start-up date or eighteen (18) months from manufacturer shipment date, whichever occurs first.

However, this warranty does not apply to any product which has been subject to misuse, misapplication, neglect (including without limitation, inadequate maintenance, accident, improper installation, modification, adjustment, repair or any other cases originated from inadequate applications).

The company will neither be responsible for any expenses incurred in installation, removal from service, consequential expenses such as financial losses nor transportation costs as well as tickets and accommodation expenses of a technician when this is requested by the customer.

The repair and/or replacement of parts or components, when effected by WEG within the Warranty period do not give Warranty extension, unless otherwise expressed in writing by WEG.

This constitutes WEG's only warranty in connection with this sale and is in lieu of all other warranties, expressed or implied, written or oral.

There are no implied warranties of merchantability or fitness for a particular purpose that apply to this sale.

No employee, agent, dealer, repair shop or other person is authorized to give any warranties on behalf of WEG nor to assume for WEG any other liability in connection with any of its products.

In case this happens without WEG's authorization, Warranty is automatically cancelled.

LIABILITY

Except as specified in the foregoing paragraph entitled "Warranty Terms for Engineering Products", the company shall have no obligation or liability whatsoever to the purchaser, including, without limitation, any claims for consequential damages or labor costs, by reason of any breach of the express warranty described therein.

The purchaser further hereby agrees to indemnify and hold the company harmless from any causes of action (other than cost of replacing or repairing the defective product as specified in the foregoing paragraph entitled "Warranty Terms for Engineering Products"), arising directly or indirectly from the acts, omissions or negligence of the purchaser in connection with or arising out of the testing, use, operation, replacement or repair of any product described in this quotation and sold or furnished by the company to the purchaser.



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This image shows a full page of blank, lined paper. It features approximately 28 evenly spaced horizontal black lines across its entire width, providing a guide for handwriting or typing. The background is a solid off-white color.



Estimado Cliente,

Gracias por adquirir el alternador de WEG. Es un producto desarrollado con niveles de calidad y eficiencia que garantizan un excelente desempeño.

La energía eléctrica ejerce un papel de relevante importancia para el confort y bienestar de la humanidad. Como es el alternador el responsable por la generación de esta energía, éste necesita ser identificado y tratado como una máquina, cuyas características implican en determinados cuidados, como de almacenaje, instalación y mantenimiento.

Todos los esfuerzos han sido hechos para que las informaciones contenidas en este manual sean fidedignas a las configuraciones y utilización del alternador.

De esta forma, lea atentamente este manual antes de proceder la instalación, operación o mantenimiento del alternador, para permitir la operación segura y continua del alternador y también para garantizar su seguridad y de sus instalaciones. Para cualquier duda póngase en contacto con WEG.

Mantenga este manual siempre cerca al alternador, para que pueda consultarlo cuando necesario.



ATENCIÓN

1. Es imprescindible seguir los procedimientos contenidos en este manual para que la garantía tenga validez;
2. Los procedimientos de instalación, operación y mantenimiento del alternador deberán hacerse por personal calificado.



NOTAS

1. La reproducción de las informaciones de este manual, total o en partes, se permite desde que la fuente sea citada;
2. Si se extraviar este manual, el archivo electrónico en formato PDF está disponible en el sitio www.weg.net o podrá ser solicitada otra copia impresa.

WEG EQUIPAMENTOS ELÉTRICOS S.A.





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1 INTRODUCCIÓN

Este manual tiene por objetivo atender los alternadores de la línea G. Pueden ser suministrados alternadores con especialidades, con documentos específicos (dibujos, esquema de conexión, curvas características, etc.). Estos documentos deben ser cuidadosamente evaluados, junto con este manual, antes de proceder a la instalación, operación o mantenimiento del alternador.

Consulte a WEG en caso de que exista la necesidad de alguna aclaración adicional. Todos los procedimientos y normas constantes en este manual deberán ser seguidos para garantizar el buen funcionamiento del alternador y la seguridad de los profesionales implicados en la operación del mismo. Observar estos procedimientos es igualmente importante para asegurar la validez de la garantía del alternador. De esta forma, recomendamos la lectura minuciosa de este manual antes de la instalación y operación del alternador. En caso de que persista alguna duda, consulte a WEG.



ATENCIÓN

En caso de cambio de los componentes citados en este manual, deberá ser observada la fecha de fabricación del alternador, en relación a la fecha de revisión del manual.

1.1 AVISOS DE SEGURIDAD EN EL MANUAL

En este manual son utilizados los siguientes avisos de seguridad:



PELIGRO

La no-consideración de los procedimientos recomendados en este aviso, puede llevar a la muerte, heridas graves y daños materiales considerables.



ATENCIÓN

La no-consideración de los procedimientos recomendados en este aviso puede llevar a daños materiales.



NOTA

El texto objetiva suministrar informaciones importantes para la correcta atención y el buen funcionamiento del producto.



1.2 NOMENCLATURA

G T A 16 1 A I SR

LÍNEA DEL ALTERNADOR

G - Máquina Sincrónica - Línea G

CARACTERÍSTICA DE EXCITACIÓN

T - Alternador brushless con bobina auxiliar

P - Alternador brushless con excitatriz auxiliar (PMG)

S - Alternador brushless sin bobina auxiliar y sin excitatriz auxiliar

TIPO DE REFRIGERACIÓN

A - Abierto autoventilado

F - Cerrado con intercambiador de calor aire-aire

W - Cerrado con intercambiador de calor aire-agua

K - Cerrado con carcasa aletada

CARCASA - IEC

16 - carcasa 160

20 - carcasa 200 ...

LARGO DE LA CARCASA

1 - Carcasa corta

2 - Carcasa média

3 - Carcasa larga

TENSIÓN

A - Trifásico - 12 terminales - 480/240V - 440/220V - 380/190V - 208V (60 Hz)
400/200V - 380/220/190V (50Hz)

B - Trifásico - 6 terminales - 220V/60Hz o 190V/50Hz

C - Trifásico - 6 terminales - 380V/60Hz

D - Trifásico - 6 terminales - 440V/60Hz o 380V/50Hz

E - Trifásico - 6 terminales - 480V/60Hz o 400V/50Hz

F - Trifásico - 6 terminales - 600V/60Hz o 575V/60Hz

G - Trifásico - 6 terminales - 208V/60Hz

H - Trifásico - 6 terminales - 415V/50Hz

I - Trifásico - 6 terminales - 2300V/60Hz

J - Trifásico - 6 terminales - 4160V/60Hz

K - Trifásico - 6 terminales - 6600V/60Hz

L - Trifásico - 6 terminales - 13800V/60Hz

M - Trifásico - 6 terminales - 3300V/50Hz

N - Trifásico - 6 terminales - 6000V/50Hz

O - Trifásico - 6 terminales - 11000V/50Hz

P - Trifásico - 12 terminales - 415/240/208/120V (50Hz)

Z - Otra tensión

APLICACIÓN

I - Industrial

M - Cerca del mar

T - Telecomunicaciones

N - Naval

E - Especial

CÓDIGO COMPLEMENTAR

Código referente a la potencia del alternador



2 INSTRUCCIONES GENERALES

Todos los que trabajan con instalaciones eléctricas, sea en el montaje, en la operación o en el mantenimiento, deberán ser permanentemente informados y estar actualizados sobre las normas y prescripciones de seguridad que rigen el servicio y es aconsejable observarlas rigurosamente. Antes del inicio de cualquier trabajo, le compete al responsable certificarse de que todo fue debidamente observado y alertar a su personal sobre los peligros inherentes a la tarea que será ejecutada. Los motores de este tipo, cuando son aplicados inadecuadamente o reciben mantenimiento deficiente, o todavía cuando reciben intervención de personas no capacitadas, pueden causar serios daños personales y/o materiales. Así, se recomienda que estos servicios sean ejecutados siempre por personal capacitado.

2.1 PERSONAS CAPACITADAS

Se entiende por personas capacitadas aquellas que, en función de su entrenamiento, experiencia, nivel de instrucción, conocimientos en normas relevantes, especificaciones, normas de seguridad, prevención de accidentes y conocimiento de las condiciones de operación, hayan sido autorizadas por los responsables para la realización de los trabajos necesarios y que puedan reconocer y evitar posibles peligros. Estas personas capacitadas también deben conocer los procedimientos de primeros auxilios y ser capaces de prestar estos servicios, en caso necesario. Se presupone que todo trabajo de arranque, mantenimiento y reparaciones es hecho únicamente por personas capacitadas.

2.2 INSTRUCCIONES DE SEGURIDAD



PELIGRO

Durante la operación, estos equipos poseen partes energizadas o giratorias expuestas, que pueden presentar alta tensión o altas temperaturas.

Así, la operación con cajas de conexión abiertas, acoplamientos no protegidos, o manipulación errónea, sin considerar las normas de operación, puede causar graves accidentes personales y materiales.

Los responsables por la seguridad de la instalación deben garantizar que:

- Solamente personas capacitadas efectúen la instalación y operación del equipo;
- Estas personas tengan en manos este manual y demás documentos suministrados con el motor, y que realicen los trabajos observando rigurosamente las instrucciones de servicio, las normas pertinentes y la documentación específica de los productos;

El incumplimiento de las normas de instalación y de seguridad puede anular la garantía del producto.

Los equipos para combate a incendios y avisos sobre primeros auxilios deberán estar en el lugar de trabajo en lugares bien visibles y de fácil acceso.

Deben observar también:

- Todos los datos técnicos respecto a las aplicaciones permitidas (condiciones de funcionamiento, conexiones y ambiente de instalación), contenidos en el catálogo, en la documentación del pedido, en las instrucciones de operación, en los manuales y demás documentaciones;
- Las determinaciones y condiciones específicas para la instalación lugar;
- El empleo de herramientas y equipos adecuados para la manipulación y transporte;

- Que los dispositivos de protección de los componentes individuales sean removidos poco antes de la instalación.

Las piezas individuales deben ser almacenadas en ambientes libres de vibraciones, y se deben evitar caídas y asegurar que estén protegidas contra agentes agresivos y/o que coloquen en riesgo la seguridad de las personas.

2.3 NORMAS

Los alternadores son especificados, proyectados, fabricados y probados de acuerdo con las siguientes normas:

Tabla 2.1: Normas aplicables a motores de inducción trifásicos

	IEC	NBR	ISO
Especificación	60034-1	5117	
Dimensiones	60072	5432	
Ensayos	60034-4	5052	
Grados de protección	60034-5	9884	
Refrigeración	60034-6	5110	
Formas Constructivas	60034-7	5031	
Ruido	60034-14	5117	8528

2.4 CARACTERÍSTICAS DEL AMBIENTE

Em conformidade com as normas IEC-60034.1 e ABNT 5117, as condições ambientais de funcionamento para as quais os alternadores foram projetados são as seguintes:

1. Temperatura ambiente: -15°C a $+40^{\circ}\text{C}$;
2. Altitude (a.n.m.): até 1000 m;
3. Ambiente sin presencia de agentes agresivos, como: neblina salina, productos químicos, etc.;
4. Ambientes de acuerdo con el grado de protección del alternador.

En la placa de características y en la hoja de datos técnicos específica del alternador son descritas las condiciones especiales de ambiente.



ATENCIÓN

Para utilización de los alternadores con refrigeración a agua, en temperaturas por debajo de 0°C , deben ser añadidos aditivos anticongelantes en el agua.



2.4.1 Ambientes agresivos y/o marinizados

El alternador industrial estándar no debe ser utilizado en ambientes agresivos, ya que éste estará sujeto a la acción de intemperies que pueden causar corrosión de partes mecánicas y disminución de la resistencia de aislamiento de las bobinas y como consecuencia, la quema del alternador. En estas situaciones, WEG no se responsabiliza por daños que puedan ocurrir en el alternador, descaracterizando la garantía del producto conforme el certificado de garantía WEG.



NOTA

Los alternadores aplicados en ambientes agresivos deben estar provistos de protecciones adicionales contra corrosión y bajo aislamiento, asegurando, cuando sea solicitado, la garantía de desempeño del producto.

Son considerados ambientes agresivos: ambiente marítimo o con concentración de salinidad y/o humedad elevada, materiales en suspensión que puedan ser abrasivos, aplicación naval y ambiente con alta variación de temperatura. En estos casos, se debe consultar a WEG para una correcta especificación del alternador para la aplicación requerida.

2.5 CONDICIONES DE OPERACIÓN

Para que el certificado de garantía del producto tenga validez, el alternador debe operar de acuerdo con los datos nominales, seguir las normas y códigos aplicables y las informaciones contenidas en este manual.



3 RECIBIMIENTO, ALMACENAMIENTO Y MANIPULACIÓN

3.1 RECIBIMIENTO

Todos los alternadores suministrados son probados y están en perfectas condiciones de operación. Las superficies maquinadas son protegidas contra corrosión. El embalaje deberá ser revisado inmediatamente después de su recepción para verificar si no sufrió eventuales daños durante el transporte.



ATENCIÓN

Toda y cualquier avería deberá ser fotografiada, documentada y comunicada inmediatamente a la empresa transportadora, a la aseguradora y a WEG. La no comunicación acarreará la pérdida de la garantía.



ATENCIÓN

Las piezas suministradas en embalajes adicionales deben ser conferidas en el recibimiento.

- Al izar el embalaje (o el container), deben ser observados los lugares correctos para izamiento, el peso indicado en el embalaje o en la placa de identificación, así como la capacidad y el funcionamiento de los dispositivos de izamiento;
- Los alternadores acondicionados en cajones esqueleto de madera deben ser izados siempre por sus propios cáncamos o por apiladora adecuada. Nunca deben ser izados por su esqueleto;
- El embalaje nunca podrá ser volcado. Colóquelo en el piso con cuidado (sin causar impactos) para evitar daños a los cojinetes;
- No remueva la grasa de protección contra corrosión de la punta del eje ni las gomas o tapones de cierre de los agujeros de las cajas de conexiones;
- Estas protecciones deberán permanecer en el lugar hasta la hora del montaje final. Después de retirar el embalaje, se debe hacer una completa inspección visual del alternador;
- El sistema de trabamiento de eje debe ser removido solamente poco antes de la instalación y almacenado en lugar seguro para futuro transporte del alternador.

3.2 ALMACENAMIENTO

Cualquier daño en la pintura o en las protecciones contra oxidación de las partes maquinadas deberá ser retocado.



ATENCIÓN

Las resistencias de calentamiento deben permanecer conectadas durante el almacenamiento para evitar la condensación de agua en el interior del alternador.

3.2.1 Almacenamiento en ambiente abrigado

En el caso de que el alternador no sea instalado inmediatamente después del recibimiento, deberá permanecer dentro del embalaje y almacenado en lugar protegido contra humedad, vapores, cambios de calor repentinos, roedores e insectos.

Para que los cojinetes no sean dañificados, el alternador debe ser almacenado en lugares exentos de vibraciones.

3.2.2 Almacenamiento en ambiente desabrigado

El alternador debe ser almacenado en lugar seco, libre de inundaciones y de vibraciones.

Repare todos los daños en el embalaje antes de almacenar el alternador, lo que es necesario para asegurar condiciones apropiadas de almacenamiento. Posicione el alternador sobre tarimas o bases que garanticen protección contra la humedad de la tierra y que impidan que el mismo se entierre en el suelo. Debe ser asegurada una libre circulación de aire por debajo del alternador.

La cobertura o lona usada para proteger el alternador contra la intemperie no debe estar en contacto con las superficies del mismo. Para asegurar la libre circulación de aire entre el alternador y la cobertura, coloque bloques de madera como espaciadores.

3.2.3 Almacenamiento prolongado

Cuando el alternador queda almacenado por un largo período antes de la colocación en operación, queda expuesto a influencias externas, como fluctuaciones de temperatura, humedad, agentes agresivos, etc.

Los espacios vacíos en el interior del alternador, como de los rodamientos, caja de conexiones y bobinas, quedan expuestos a la humedad del aire, que se puede condensar y, dependiendo del tipo y del grado de contaminación del aire, también sustancias agresivas pueden penetrar en estos espacios vacíos.

Como consecuencia, después de períodos prolongados de almacenamiento, la resistencia de aislamiento de la bobina puede caer a valores inferiores a lo admisible, componentes internos como rodamientos se pueden oxidar y el poder de lubricación del agente lubricante en los cojinetes puede ser afectado. Todas estas influencias aumentan el riesgo de daño antes del arranque del alternador.



ATENCIÓN

Para no perder la garantía del alternador, se debe asegurar que todas las medidas preventivas descritas en este manual, sean seguidas y registradas.

Las instrucciones descritas a seguir son válidas para alternadores que son almacenados por largos períodos y/o quedan parados por dos meses o más.



3.2.3.1 Lugar de almacenamiento

Para asegurar las mejores condiciones de almacenamiento del motor durante largos períodos, el lugar escogido debe obedecer rigurosamente a los criterios descriptos a seguir.

3.2.3.1.1 Almacenamiento en ambiente abrigado

- El ambiente debe ser cerrado y cubierto;
- El lugar debe estar protegido contra humedad, vapores, agentes agresivos, roedores e insectos;
- No puede haber presencia de gases corrosivos, como cloro, dióxido de azufre o ácidos;
- El ambiente debe estar libre de vibraciones continuas o intermitentes;
- El ambiente debe poseer sistema de ventilación con filtro de aire;
- Temperatura ambiente entre 5°C y 60°C, sin fluctuación de temperatura súbita;
- Humedad relativa del aire <50%;
- Poseer prevención contra suciedad y depósitos de polvo;
- Poseer sistema de detección de incendio;
- Debe estar provisto de electricidad para alimentación de las resistencias de calentamiento.

En el caso de que alguno de estos requisitos no sea atendido en el lugar del almacenamiento, WEG sugiere que sean incorporadas protecciones adicionales al embalaje del alternador durante el período de almacenamiento, según lo siguiente:

- Caja de madera cerrada o similar con instalación eléctrica que permita que las resistencias de calentamiento puedan ser energizadas;
- En el caso de que exista riesgo de infestación y formación de hongos, el embalaje debe ser protegido en el lugar de almacenamiento, rociándolo o pintándolo con agentes químicos apropiados;
- La preparación del embalaje debe ser hecha con cuidado por una persona experimentada.

3.2.3.1.2 Almacenamiento en ambiente desabrigado

No se recomienda el almacenamiento externo del alternador (a la intemperie).

En el caso de que el almacenamiento externo no pudiera ser evitado, el alternador debe estar acondicionado en embalaje específico para esta condición, según lo siguiente:

- Para almacenamiento externo (a la intemperie), además del embalaje recomendado para almacenamiento interno, el embalaje debe ser cubierto con una protección contra polvo, humedad y otros materiales extraños, utilizando para esta finalidad una lona o plástico resistente;
- Posicionar el embalaje sobre tarimas o bases que garanticen la protección contra la humedad de la tierra y que impidan que se hunda en el suelo;
- Después de que el alternador esté cubierto, se debe erguir una protección contra la lluvia directa, nieve y sol.



ATENCIÓN

En el caso de que el alternador permanezca almacenado por largos períodos, se recomienda inspeccionar regularmente conforme se especifica en el párrafo **Plan de mantenimiento durante el almacenamiento** de este manual.

3.2.3.2 Piezas separadas

- En el caso de que hayan sido suministradas piezas separadas (cajas de conexión, tapas, etc.), estas piezas deberán ser embaladas conforme se especifica en los párrafos **Almacenamiento interno** y **Almacenamiento externo** de este manual;
- La humedad relativa del aire dentro del embalaje no deberá exceder 50%.

3.2.3.3 Resistencia de calentamiento

Las resistencias de calentamiento del alternador deben permanecer energizadas durante el período de almacenamiento para evitar la condensación de la humedad en el interior del alternador y así asegurar que la resistencia del aislamiento de las bobinas permanezca en niveles aceptables.



ATENCIÓN

La resistencia de calentamiento del alternador debe ser conectada obligatoriamente cuando este se encuentra almacenado en lugar con temperatura < 5°C y humedad relativa del aire > 50%.

3.2.3.4 Resistencia de aislamiento

Durante el período de almacenamiento, la resistencia de aislamiento de las bobinas del alternador debe ser medida y registrada cada tres meses y antes de la instalación del alternador.

Las caídas eventuales del valor de la resistencia de aislamiento deben ser investigadas.

3.2.3.5 Superficies maquinadas expuestas

Todas las superficies maquinadas expuestas (por ejemplo, punta de eje y bridas) son protegidas en la fábrica con un agente protector temporario (inhibidor de oxidación). Esta película protectora debe ser reaplicada por lo menos cada seis meses o cuando fuera removida y/o dañificada.

Productos Recomendados:

Nombre: Dasco Guard 400 TX AZ, Fabricante: D.A. Stuart Ltda

Nombre: TARP, Fabricante: Castrol.



3.2.3.6 Cojinetes

3.2.3.6.1 Cojinetes blindados (hasta carcasa 315)

Durante el período de almacenamiento, cada dos meses, se debe retirar el dispositivo de traba del eje y girarlo manualmente para distribuir la grasa dentro del rodamiento y de esta forma conservar el cojinete en buenas condiciones. En caso de que el alternador permanezca almacenado por un período mayor a 2 años, los rodamientos deberán ser sustituidos.

3.2.3.6.2 Cojinetes relubricables (carcasa 355 y mayores)

Los rodamientos son lubricados en la fábrica para test. Durante el período de almacenamiento, cada dos meses se debe retirar el dispositivo de traba del eje y girarlo manualmente para conservar el cojinete en buenas condiciones. Tras 6 meses de almacenamiento, y antes de la entrada en operación, los rodamientos deben ser relubricados. En caso de que el alternador permanezca almacenado por un período mayor a 2 años, los rodamientos deberán ser lavados, inspeccionados para garantía de su integridad, así como relubricados.



ATENCIÓN

En caso de que no sea posible girar el eje del alternador, conforme es recomendado, verifique las condiciones del rodamiento antes de poner el alternador en funcionamiento.

3.2.3.7 Caja de conexiones

Cuando la resistencia de aislamiento de las bobinas del alternador sea medida, se debe inspeccionar también la caja de conexiones principal y las demás cajas de conexiones, considerando especialmente los siguientes aspectos:

- El interior debe estar seco, limpio y libre de cualquier deposición de polvo;
- Los elementos de contacto no pueden presentar corrosión;
- Los sellados deben estar en condiciones apropiadas;
- Las entradas de los cables deben estar correctamente selladas.

Si alguno de estos ítems no está correcto, se debe hacer una limpieza o reposición de piezas.

3.2.3.8 Inspecciones y registros durante el almacenamiento

El alternador almacenado debe ser inspeccionado periódicamente y los registros de inspección deben ser archivados.

Los siguientes puntos deben ser inspeccionados:

1. Daños físicos;
2. Limpieza;
3. Indicios de condensación de agua;
4. Condiciones del revestimiento protector;
5. Condiciones de la pintura;
6. Indicios de vermes o acción de insectos;
7. Operación satisfactoria de las resistencias de calentamiento. Se recomienda que sea instalado un

sistema de señalización o alarma en el lugar para detectar la interrupción de energía de las resistencias de calentamiento;

8. Registre la temperatura ambiente y humedad relativa alrededor de la máquina, la temperatura de la bobina (utilizando RTDs), la resistencia de aislamiento y el índice de polarización;
9. Inspeccione también el lugar de almacenamiento para que esté de acuerdo con los criterios descritos en el párrafo **Lugar de almacenamiento**.

3.2.3.9 Preparación para puesta en marcha

3.2.3.9.1 Limpieza

- El interior y el exterior del alternador deben estar libres de aceite, agua, polvo y suciedad. El interior del alternador debe ser limpiado con aire comprimido con presión reducida;
- Remover el inhibidor de oxidación de las superficies expuestas con un paño embebido en solvente a base de petróleo;
- Certificarse de que los cojinetes y cavidades utilizadas para lubricación estén libres de suciedad y que los tapones de las cavidades estén correctamente sellados y apretados. Las oxidaciones y marcas en los asientos de los cojinetes y eje deben ser cuidadosamente removidas.

3.2.3.9.2 Lubricación de los cojinetes

En alternadores con cojinetes relubricables, relubríquelos utilizando el lubricante especificado. Las informaciones de los cojinetes y lubricantes, así como el procedimiento para lubricación, se encuentran indicados en el ítem **"Mantenimiento de los Cojinetes"** de este manual.

3.2.3.9.3 Verificación de la resistencia de aislamiento



ATENCIÓN

Antes de colocar el alternador en operación, se debe medir la resistencia de aislamiento, conforme el párrafo **Resistencia de aislamiento** de este manual.

3.2.3.9.4 Otros

Siga los demás procedimientos descritos en el párrafo **Comisionamiento** de este manual antes de colocar el alternador en operación.



3.2.3.10 Plan de mantenimiento durante el almacenamiento

Durante el período de almacenamiento, el mantenimiento del motor deberá ser ejecutado y registrado de acuerdo con el plan descrito en la Tabla 3.1.

Tabla 3.1: Plan de almacenamiento

	Mensual	Cada 2 meses	Cada 6 meses	La cada 2 años	Antes de entrar en operación	Nota
Lugar de Almacenamiento						
Inspeccionar las condiciones de limpieza		X			X	
Inspeccionar las condiciones de humedad y temperatura		X				
Verificar indicios de infestaciones de insectos		X				
Medir el nivel de vibración	X					
Embalaje						
Inspeccionar daños físicos			X			
Inspeccionar la humedad relativa en el interior		X				
Cambiar el deshumidificador en el embalaje (si hubiera)			X			Cuando sea necesario
Resistencia de calentamiento (si hay)						
Verificar las condiciones de operación	X					
Alternador completo						
Realizar limpieza externa			X		X	
Realizar limpieza interna					X	
Verificar las condiciones de la pintura			X			
Verificar el inhibidor de oxidación en las partes maquinadas expuestas			X			
Devanados						
Medir la resistencia de aislamiento		X			X	
Medir el índice de polarización		X			X	
Caja de conexiones y terminales de puesta a tierra						
Limpiar el interior de las cajas				X	X	
Inspeccionar los sellos y sellados				X	X	
Reapretar los bornes de conexión					X	
Cojinetes de rodamiento relubricables						
Girar el eje del alternador		X				
Relubricar el cojinete			X		X	
Desmontar, limpiar, inspeccionar y relubricar el cojinete				X	X	Si el período de almacenamiento es mayor a 2 años
Cojinetes de rodamiento blindados						
Girar el eje del alternador		X				
Sustituir el rodamiento				X		



3.3 MANOSEO

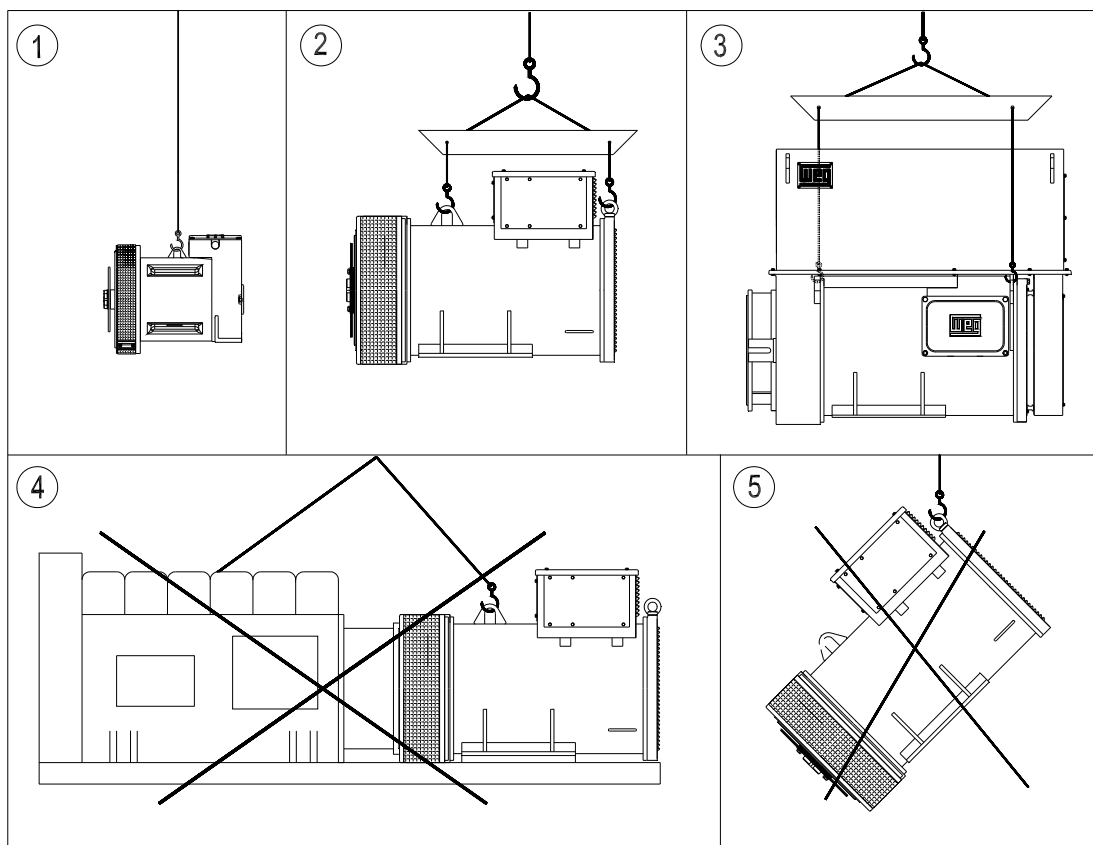


Figura 3.1: Manoseo do alternador

- Las posiciones 1, 2 y 3 del diseño arriba, representan la forma correcta de manoseo de los alternadores y las posiciones 4 y 5 representan la forma errada.
- El alternador fue proyectado con cáncamos de suspensión para su levantamiento. Estos cáncamos son previstos para levantar solamente el alternador, o sea, cargas adicionales no son permitidas.
- Los cables y dispositivos de levantamiento deben ser apropiados.



NOTAS

- Observar el peso indicado.
- No izar ni colocar el alternador bruscamente en el piso, pues eso podrá causar daños a los cojinetes;
- Para izar el alternador, usar solamente los cáncamos provistos para esta finalidad. Si es necesario, usar una travesaño para proteger partes del alternador;
- Los cáncamos en las tapas, cojinetes, caja de conexiones, etc., sirven solo para manipular estos componentes separadamente;
- Nunca usar el eje para izar el alternador;
- Para mover el motor, el eje tiene que estar trabado con el dispositivo de traba suministrado con el alternador.
- Después de la retirada del dispositivo de seguridad de la parte delantera, cuando levantar el alternador, lo mismo no debe ser inclinado con la parte delantera para abajo con riesgo de caída del rotor.



ATENCIÓN

Los cables de acero, manillas y los equipos para izamiento deben tener capacidad para soportar el peso del alternado, para evitar accidentes, daños al alternador o daños personales.



4 INSTALACIÓN

4.1 LOCAL DE INSTALACIÓN

Los alternadores deben ser instalados en locales de fácil acceso, que permitan la realización de inspecciones periódicas, de mantenimientos locales y la retirada de los equipamientos para servicios externos, si necesario. Las siguientes características ambientales deben ser aseguradas:

- Los alternadores deben recibir aire fresco y limpio y el sitio de instalación debe permitir el fácil escape (para fuera del ambiente de operación del equipamiento) del aire extraído, evitándose realimentación.
- Debe ser evitada la aspiración del escape del diesel, pues el hollín es conductor eléctrico, pudiendo provocar sobre calentamiento, reduciendo la vida útil del aislamiento pudiendo hasta venir a provocar la quema del alternador.
- La presencia de otros equipos o paredes no debe dificultar u obstruir la ventilación del alternador;
- El espacio alrededor y arriba del alternador debe ser suficiente para mantenimiento o manipulación del mismo;
- El ambiente debe estar de acuerdo con el grado de protección del alternador.



NOTA

Para alternadores con cojinete único, el dispositivo de trabado del eje (utilizado para protección del conjunto rotor/estator contra daños durante el transporte), debe ser retirado solamente poco antes de acoplarlo a la máquina accionante.

4.2 SENTIDO DE GIRO

Los alternadores estándar pueden trabajar en ambos los sentidos de giro.

La secuencia de fases está ajustada para el sentido de giro **horario** (visto en la frente de la punta de eje del alternador - Lado Accionado).

Los bornes de los alternadores están señalados de tal forma, que la secuencia de los bornes 1, 2 y 3 concuerda con la secuencia de las fases R, S y T o L1, L2 y L3, cuando el sentido de giro es horario.

Cuando estos alternadores necesitan trabajar en sentido **antihorario**, la secuencia de las fases debe ser cambiada (si necesario). Recomendamos verificar el sentido de giro y la secuencia de las fases necesarias antes de la puesta en marcha del alternador.



ATENCIÓN

La secuencia de las fases equivocada puede ocasionar daños a los equipos energizados por el alternador.

Cuando 2 o más alternadores trabajan en paralelo o alternadores en paralelo con la red, deben tener la misma secuencia de fases.

4.3 GRADO DE PROTECCIÓN

Es de fundamental importancia, para el buen desempeño del alternador y para su durabilidad, que sea observado el grado de protección del equipo en relación con el ambiente de instalación.

El alternador estándar posee grado de protección IP21 (protegidos contra penetración de cuerpos sólidos de dimensiones mayores de 12mm y contra respingos de agua en la vertical).

4.4 REFRIGERACIÓN

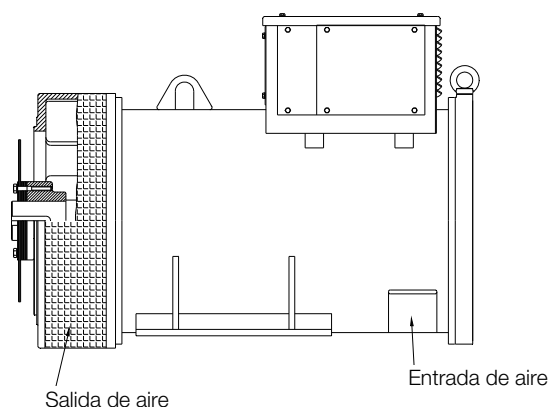


Figura 4.1: Sistema de refrigeración

El ventilador se encuentra alojado en el lado accionado, junto al rotor. El aire entra por el lado no accionado e sale por las aperturas radiales existentes en la tapa / brida do lado accionado.

4.5 RESISTENCIA DE AISLAMIENTO

4.5.1 Instrucciones de seguridad



PELIGRO

Para hacer la medición de la resistencia de aislamiento, el alternador debe estar parado y desconectado de la carga. El regulador de tensión debe estar desconectado.

La bobina en test debe ser conectada a la carcasa y a tierra hasta remover la carga electrostática residual.

La no observación de estos procedimientos puede resultar en daños personales.

4.5.2 Consideraciones generales

Cuando el alternador no es colocado inmediatamente en operación, debe ser protegido contra humedad, temperatura elevada y suciedad, para evitar que la resistencia de aislamiento sea afectada.

La resistencia de aislamiento de la bobina debe ser medida antes de colocar el alternador en operación. Si el ambiente es muy húmedo, la resistencia de aislamiento debe ser medida en intervalos periódicos durante el almacenamiento. Es difícil establecer reglas fijas para el valor real de la resistencia de aislamiento de un



alternador, ya que ella varía con las condiciones ambientales -temperatura, humedad), condiciones de limpieza de la máquina (polvo, aceite, grasa, suciedad)- y con la calidad y condiciones del material aislante utilizado. La evaluación de los registros periódicos de seguimiento es útil para concluir si el alternador está apto a operar.



NOTA

La resistencia de aislamiento debe ser medida con un **megóhmetro**.

4.5.3 Medición en el bobinado del estator

La tensión de test para las bobinas del estator de los alternadores debe ser conforme Tabela 4.1 de acuerdo con la norma IEEE43.

Tabela 4.1: Tensão para medição da resistência de isolamento

Tensión nominal de la bobina (V)	Test de resistencia de aislamiento Tensión continua (V)
< 1000	500
1000 - 2500	500 - 1000
2501 - 5000	1000 - 2500
5001 - 12000	2500 - 5000
> 12000	5000 - 10000

Antes de realizar la medición en la bobina del estator, verifique lo siguiente:

- Si todos los cables de la carga están desconectados;
- Si el regulador de tensión está desconectado.
- Si la carcasa del alternador y las bobinas no medidas están puestas a tierra;
- Si la temperatura de la bobina fue medida;
- Si todos los sensores de temperatura están puestos a tierra.

La medición de la resistencia de aislamiento de las bobinas del estator debe ser hecha en la caja de conexión principal.

El medidor (megóhmetro) debe ser conectado entre la carcasa del alternador y la bobina. La carcasa debe ser puesta a tierra y las 3 fases de la bobina del estator deben permanecer conectadas en el punto neutro, conforme la figura de abajo:

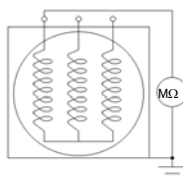


Figura 4.2: Medição nas 3 fases

Cuando sea posible, cada fase debe ser aislada y testeada separadamente. El test separado permite la comparación entre las fases. Cuando una fase es testeada, las otras dos deben ser puestas a tierra en la misma puesta a tierra de la carcasa, conforme la figura de abajo.

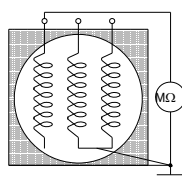


Figura 4.3: Medição em fases separadas

4.5.4 Medição no enrolamento do rotor, excitatriz e acessórios

Medición en la bobina del rotor:

- Desconecte los cables del rotor del conjunto de diodos;
- Conecte el medidor de resistencia de aislamiento (megóhmetro) entre la bobina del rotor y el eje del alternador. La corriente de la medición no puede pasar por los cojinetes.

Medición de la bobina del estator de la excitatriz principal.

- Desconecte los cables de alimentación de la excitatriz;
- Conecte el medidor de resistencia de aislamiento (megóhmetro) entre la bobina del estator de la excitatriz (terminales I y K) y la carcasa del alternador.

Medición en la bobina del rotor de la excitatriz principal:

- Desconecte los cables del rotor de la excitatriz del conjunto de diodos;
- Conecte el medidor de resistencia de aislamiento (megóhmetro) entre la bobina del rotor y el eje del alternador. La corriente de la medición no puede pasar por los cojinetes.

Medición de la bobina del estator de la excitatriz auxiliar (PMG) – alternadores modelo GP-- :

- Desconecte los cables que conectan la excitatriz auxiliar al regulador de tensión;
- Conecte el medidor de resistencia de aislamiento (megóhmetro) entre la bobina del estator de la excitatriz auxiliar y la carcasa del alternador.



ATENCIÓN

La tensión del test para el rotor, excitatriz principal, excitatriz auxiliar y resistencia de calentamiento debe ser 500Vcc, demás accesorios 100Vcc. No es recomendada la medición de resistencia de aislamiento de protectores térmicos.

En máquinas que ya están en operación, pueden ser obtenidos valores superiores de resistencia de aislamiento, comparados a los valores iniciales de comisionamiento.

La comparación con valores obtenidos en ensayos anteriores en la misma máquina, en condiciones similares de carga, temperatura y humedad, sirve como una mejor indicación de las condiciones del aislamiento que el valor obtenido en un único ensayo, siendo considerada sospechosa cualquier reducción brusca.

Tabela 4.2: Límites orientadores de la resistencia de aislamiento en máquinas eléctricas

Valor de la resistencia del aislamiento	Evaluación del aislamiento
2MΩ o menor	Peligroso
< 50MΩ	Malo
50...100MΩ	Regular
100...500MΩ	Bueno
500...1000MΩ	Muy Bueno
> 1000MΩ	Excelente



4.5.5 Resistencia de aislamiento mínima

Si la resistencia de aislamiento medida es menor que $100M\Omega$ a $40^{\circ}C$ antes de colocar el alternador en operación, las bobinas deben ser secadas de acuerdo con el procedimiento siguiente:

- Desmontar el alternador y remover el rotor y los cojinetes;
- Colocar los componentes que poseen bobina con baja resistencia de aislamiento en una estufa y calentar a una temperatura de $130^{\circ}C$, permaneciendo a esta temperatura, por lo menos por 8 horas.;
- Verificar si la resistencia de aislamiento está dentro de valores aceptables, conforme la Tabla 4.2 . Si no estuviera, consultar a WEG.

4.5.6 Índice de polarización

El índice de polarización (I.P.) es tradicionalmente definido por la relación entre la resistencia de aislamiento medida en 10 min. y la resistencia de aislamiento medida en 1 min. con temperatura relativamente constante.

El índice de polarización permite evaluar las condiciones del aislamiento del alternador conforme la Tabla 4.3.

Tabla 4.3: Índice de polarización (relación entre 10 y 1 minuto)

Índice de polarización	Evaluación del aislamiento
1 o menor	Peligroso
< 1,5	Malo
1,5 la 2,0	Regular
2,0 la 3,0	Bueno
3,0 la 4,0	Muy Bueno
> 4,0	Excelente



PELIGRO

Para evitar accidentes, es necesaria la puesta a tierra la bobina del alternador inmediatamente después de la medición de la resistencia de aislamiento.

4.5.7 Conversión de los valores medidos

La resistencia de aislamiento debe ser medida a $40^{\circ}C$. Si la medición es hecha en temperatura diferente, será necesario corregir la lectura a $40^{\circ}C$, utilizando una curva de variación de la resistencia del aislamiento en función de la temperatura obtenida en el propio alternador. Si esta curva no estuviera disponible, puede ser empleada la corrección aproximada suministrada por la curva de la Figura 4.4, conforme la NBR 5383 / IEEE43.

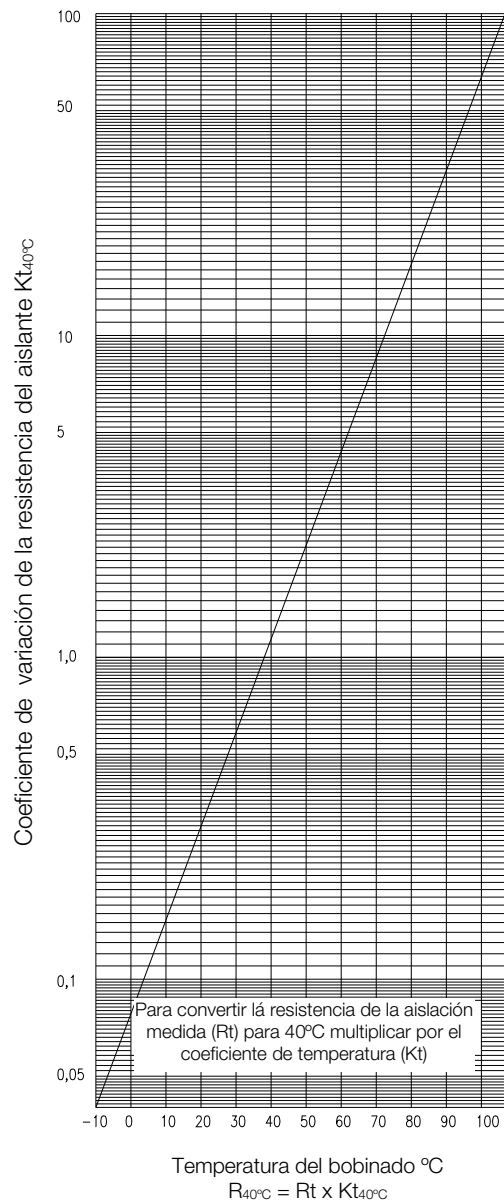


Figura 4.4: Coeficiente de variación de la resistencia de aislamiento con la temperatura

4.6 PROTECCIONES

4.6.1 Protecciones térmicas

Los alternadores poseen como parte integrante, cuando solicitados por el cliente, dispositivos de protección contra sobre elevación de temperatura, instalados en las bobinas en el estator principal y/o cojinetes, conforme sigue:

Termostato (bimetálico) - Son detectores térmicos del tipo bimetálico, con contactos de plata normalmente cerrados. Estos se abren en determinada temperatura. Los termostatos son conectados en serie o independientes conforme el esquema de conexión.

Termistores (tipo PTC o NTC) - Son detectores térmicos, compuestos de semiconductores que varían su resistencia bruscamente al alcanzar una determinada temperatura. Los termistores son conectados en serie o independientes conforme el esquema de conexión.



**NOTA**

Los termostatos y los termistores deberán ser conectados a una unidad de control que interrumpirá la alimentación del motor o accionará un dispositivo de señalización.

Termorresistencia (Pt100) - Es un elemento de resistencia calibrada. Su funcionamiento se basa en el principio de que la resistencia eléctrica de un conductor metálico varía linealmente con la temperatura. Los terminales del detector deben ser conectados a un panel de control, que incluye un medidor de temperatura.

**NOTA**

Las termorresistencias tipo RTD permiten el monitoreo de la temperatura absoluta. Con esta información, el relé podrá efectuar la lectura de la temperatura, y también la parametrización para alarma y desconexión conforme las temperaturas predefinidas.

La fórmula a seguir sirve para convertir el valor de la resistencia óhmica medida para temperatura de las termorresistencias tipo Pt 100.

$$\text{Fórmula: } \frac{\Omega - 100}{0.386} = ^\circ\text{C}$$

Donde: Ω = resistencia medida en el Pt100

Los dispositivos de protección, cuando son solicitados, están relacionados en el esquema de conexión específico de cada alternador. La no utilización de estos dispositivos es de total responsabilidad del usuario, sin embargo, puede ocasionar la pérdida de garantía en caso de daños.

4.6.1.1 Límites de temperatura para bobinados

La temperatura del punto más caliente de la bobina debe ser mantenida abajo del límite de la clase térmica del aislamiento. La temperatura total es compuesta por la suma de la temperatura ambiente con la elevación de temperatura (T), y la diferencia que existe entre la temperatura media de la bobina y el punto más caliente de la bobina.

La temperatura ambiente por norma es de, como máximo, 40°C. Arriba de ese valor, las condiciones de trabajo son consideradas especiales.

La Tabla 4.4. muestra los valores numéricos y la composición de la temperatura admisible del punto más caliente de la bobina.

Tabla 4.4: Clase de aislamiento

Clase de aislamiento		F	H
Temperatura ambiente	°C	40	40
T = elevación de temperatura (método de medición de la temperatura por la variación de la resistencia)	°C	105	125
Diferencia entre el punto más caliente y la temperatura media	°C	10	15
Total: temperatura del punto más caliente	°C	155	180

**ATENCIÓN**

En el caso de que el alternador opere con temperaturas en la bobina superiores a los valores límites de la clase térmica del aislamiento, la vida útil del aislamiento y, consecuentemente, la del alternador, será reducida significativamente o hasta puede resultar en la quema del alternador.

4.6.1.2 Protecciones térmicas para los cojinetes

Los sensores de temperatura instalados en los cojinetes (cuando existen) sirven para protegerlos de daños debido a la operación con sobretemperatura.

4.6.1.3 Temperaturas para alarma y desconexión

Las temperaturas de la alarma y desconexión deben ser parametrizadas en el valor más bajo posible. Estas temperaturas pueden ser determinadas con resultados de tests o a través de la temperatura de operación del alternador.

La temperatura de alarma puede ser ajustada a 10°C más de la temperatura de operación del alternador en plena carga, considerando siempre la mayor temperatura ambiente del lugar. Los valores de temperatura ajustados para desconexión no deben superar las temperaturas máximas admisibles conforme

Tabla 4.5: Temperatura máxima del estator

Clase de Temperatura	Temperaturas máximas de ajuste para las protecciones (°C)	
	Alarma	Desconexión
F	130	155
H	155	180

**ATENCIÓN**

Los alternadores aplicados en sistemas de emergencia (standby) pueden tener elevación de temperatura de hasta 25°C por encima de la temperatura en operación continua, conforme las normas Nema MG-1-22.40 y MG-1-22.84. La utilización del alternador en estas condiciones reduce la vida útil del alternador.

Tabla 4.6: Temperatura máxima de los cojinetes

Temperaturas máximas de ajuste para las protecciones (°C)	
Alarma	Desconexión
110	120

**ATENCIÓN**

Los valores de alarma y desconexión pueden ser definidos en función de la experiencia, no obstante no deben superar los valores máximos indicados en la Tabla 4.5 y Tabla 4.6.



4.6.2 Resistencia de calentamiento

Cuando el alternador encuentre equipado con resistencia de calentamiento para impedir la condensación de agua durante largos períodos sin operación, éstas deben ser conectadas de modo a permanecieren siempre energizadas luego después que el alternador salga de operación y desenergizadas luego que el alternador entre en operación.

El dibujo dimensional y una placa de identificación específica existente en el alternador indican el valor de la tensión de y la potencia de las resistencias instaladas.



ATENCIÓN

Caso las resistencias de calentamiento permanézcanse energizadas cuando la máquina estuviere en operación, el bobinado podrá ser dañado.

4.6.3 Protección de la bobina auxiliar

El alternador posee un fusible de protección, conectado en serie con el bobinado auxiliar o en el regulador de tensión, con la función de protegerlo contra sobre corriente.



ATENCIÓN

Si no utilizar el fusible especificado podrá ocurrir la quema del bobinado auxiliar y también del bobinado principal del estator. Este defecto no se configura garantía.

En el caso de rompimiento del fusible es necesario cambiarlo por otro de igual valor, para que el alternador opere debidamente protegida.

El fusible protege el alternador y el regulador de tensión en las siguientes situaciones:

1. Pérdida de la referencia del regulador de tensión;
2. Conexión de los cables del bobinado auxiliar en cortocircuito, hecho en los mismos cables de salida del bobinado o a través de conexión equivocada en el regulador de tensión;
3. Conexión de los terminales de salida del regulador de tensión en cortocircuito;
4. Operación con giro bajo (utilizado para calentar motor diesel), principalmente con la función U/F del regulador de tensión no habilitada: habrá la protección dependiendo de la condición de operación (rotación, ajuste del regulador...).
5. Cuando ocurrir daños en el regulador de tensión (quema del elemento de potencia o falta de referencia interna en los circuitos de comparación).
6. El fusible no rompe cuando hay cortocircuito en el de las fases del alternador. En este caso la protección debe ser hecha con relé permitiendo también el arranque motores y la sensibilización de la protección.

4.6.4 Protección de los diodos

Os diodos poseen protecciones contra sobre tensión y/o surto de tensión, conforme Tabla 4.7.

En caso de fallo de estos componentes, los mismos deben ser sustituidos.

Tabla 4.7: Protección de los diodos

	Varistor	Capacitor
GTA161 - GTA252	✓	
GTA311 - GTA561	✓	✓
Tipo de montaje	THT	THT
Item (WEG)	10049848	10391625
Características	1W, 745Vcc, 550Vca 210J/2ms	0,1µf, 2000Vcc, 630Vca

4.6.5 Protecciones en el regulador

4.6.5.1 Protección contra subfrecuencia

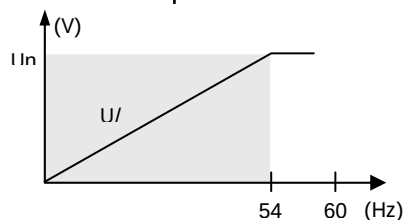
Para la puesta en marcha del alternador, la protección contra subfrecuencia debe estar regulada para 90% de la frecuencia nominal (ya sale de la fábrica con este ajuste) o permanecer con el regulador de tensión desconectado hasta el grupo llegar en la rotación nominal, evitando así sobre corrientes en el bobinado auxiliar y excitación del alternador.



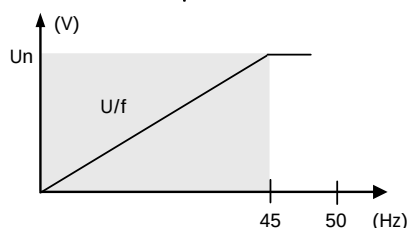
NOTA

Demás protecciones del regulador de tensión están descritas en el manual específico del mismo.

Aplicación 60HZ



Aplicación 50HZ



4.7 REGULADOR DE TENSIÓN

El regulador de tensión electrónico tiene la finalidad de mantener la tensión del alternador constante, independiente de la carga.

Puede estar alojado en la caja de conexiones del alternador o en el panel de comando.



ATENCIÓN

Verificar en el **Manual del regulador de tensión** los terminales de conexión, los trimpots para ajuste del mismo y el correcto esquema de conexión. Una conexión equivocada puede significar la quema del regulador y/o de los bobinados del alternador, en este caso no configurando garantía.



Para más detalles técnicos, funcionamiento, funciones, conexiones, ajustes, anomalías, etc., consultar el manual específico del regulador de tensión.

4.7.1 Manutenção de la corriente de cortocircuito

Los alternadores estándar son fabricados con bobinado auxiliar que consiste de grupos de bobinas insertadas en las ranuras del estator principal, aisladas del bobinado principal. Este bobinado tiene la función de alimentar el circuito de potencia del regulador de tensión e mantiene la corriente de cortocircuito del alternador.



NOTA

1. Debido al hecho del alternador mantener alta ICC, debe ser utilizado un relee de sobre corriente para abrir el disyuntor principal en el máximo 20s, sino puede ocurrir la quema del alternador;
2. Para mantener la corriente de cortocircuito arriba de $3,0 \times I_n$ hay que consultar la WEG.

4.8 ASPECTOS ELÉCTRICOS

4.8.1 Conexiones eléctricas

La conexión eléctrica es de responsabilidad del usuario final y debe ser hecha por personas calificadas. Los esquemas de conexiones posibles del alternador están en el ítem 4.8.1.1.

4.8.1.1 Conexión principal

Las conexiones de los bornes principales deben ser hechas de acuerdo con los esquemas constantes en este manual.

Las conexiones deben ser hechas con par de apriete conforme Tabla 4.8.

Tabla 4.8: Par de apriete de los tornillos de los terminales para fijación de los cables principales

Diámetro de la rosca	Par de apriete (Nm)
M5	5-6
M8	20-25
M10	39-49
M12	64-84
M16	165-206

- Certifíquese de que la sección y el aislamiento de los cables de conexión sean apropiados para la corriente y tensión del alternador.
- Antes de hacer las conexiones entre el alternador y la carga o red de energía eléctrica, es necesario que se haga una medición cuidadosa de la resistencia de aislamiento de los bobinados, conforme Tabla 4.2.

4.8.1.2 Aterramiento

Los alternadores deben ser siempre conectados a tierra con un conductor de sección adecuada, utilizando el borne alojado en uno de los pies de los mismos.

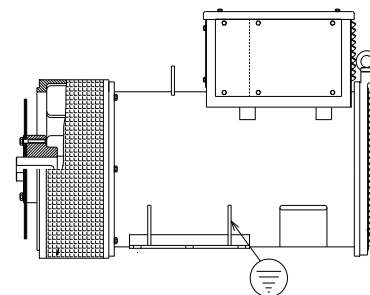


Figura 4.5: Puesta a tierra

4.8.1.3 Regulador electrónico de tensión

O regulador electrónico sale de la fábrica con las conexiones hechas para los valores de tensión y frecuencia nominales del alternador. Para cambiar las conexiones, deberá ser consultado el manual del regulador.



ATENCIÓN

Caso haber la necesidad de alteración de conexión de los bornes principales del alternador para cambiar la tensión, se debe reconectar los conductores de la tensión de referencia del regulador conforme el esquema específico. Para cambiar la frecuencia de operación del regulador de tensión, consultar el manual do mismo.

4.8.1.4 Identificación de los bornes

Terminales principales (cabos de conexión de las fases del estator)
1 a 12, N

Terminales para conexión en el regulador de tensión

E1 o E2 (marrón) - Realimentación de tensión monofásica.

E3/4 (verde) - Común de alimentación del circuito de potencia y de la realimentación monofásica del regulador de tensión.

R (azul), S (gris) y T (naranja) - realimentación de tensión trifásica.

3 (amarillo) - Alimentación del circuito de potencia del regulador de tensión.

F+ (rojo) y F- (negro) - Campo de la excitatriz principal.

AC1 (azul), AC2 (gris) y AC3 (naranja) - Estator de la excitatriz auxiliar (alimentación de potencia del regulador) - modelo GPA.

N (blanco) - Realimentación de tensión monofásica (GPA)

Terminales de los accesorios

16 a 19 – Resistencias de calentamiento.

20 a 35 – Termosensores en el estator (PT100).

36 a 51 – Termistores en el estator (PTC).

52 hasta 67 – Termostatos en el estator

68 a 71 – Termoresistencias en los cojinetes.

72 a 75 – Termistores en los cojinetes.

76 a 79 – Termostatos en los cojinetes.

80 a 82 – Dínamos taquimétricos.

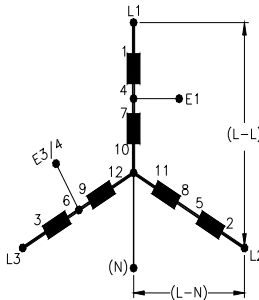
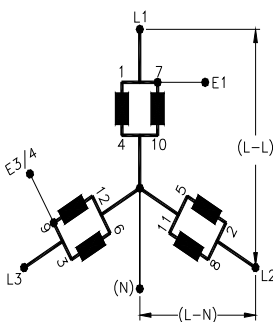
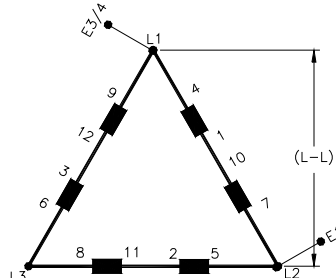
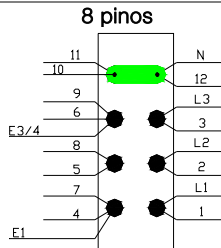
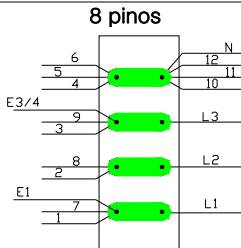
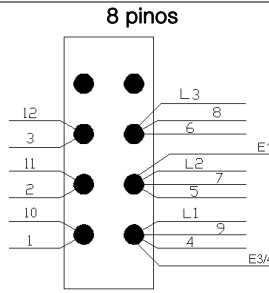
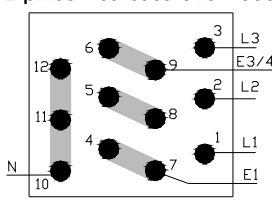
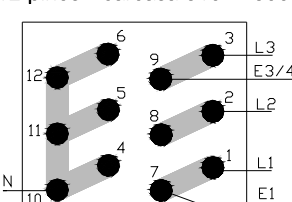
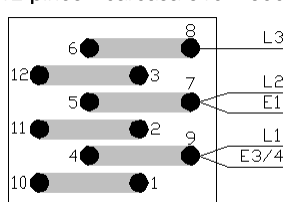
88 a 91 – Termómetros.

94 a 99 – Transformadores de Corriente



4.8.2 Diagrama de conexiones

4.8.2.1 Alternadores trifásicos – 12 terminales – (carcasas 160-200-250-315)

DIAGRAMA DE CONEXIONES		Estrella serie (neutro accesible)		Estrella paralelo (neutro accesible)		Triángulo serie
						
TENSIÓN (V)						
60Hz	L - L	380 - 415	440 - 480	190-208	220 - 240	220 - 240
	L - N	220 - 240	254 - 277	110-120	127 - 139	-
	E1 - E3/4 (Referencia)	190 - 207	220 - 240	190-208	220 - 240	220 - 240
50Hz	L - L	380 - 400		190 - 200		200 - 220
	L - N	220 - 230		110 - 115		-
	E1 - E3/4 (Referencia)	190 - 200		190 - 200		200 - 220
BORNERA	8 pinos		8 pinos		8 pinos	
						
	12 pinos - carcasa 315 - 355		12 pinos - carcasa 315 - 355		12 pinos - carcasa 315 - 355	
						



ATENCIÓN

- El alternador es suministrado con el regulador de tensión conectado para las características nominales de operación;
- En caso de mantenimiento o alteración de la conexión del alternador, conectar correctamente los cables E1, E3/4 y 3 en el regulador de tensión (E1 - E3/4, tensión de referencia) y (3 - E3/4, alimentación de potencia del regulador);
- En alternadores WEG con 12 terminales, conectar siempre los cables E1 - E3/4 del alternador en los terminales E1 y E3/4 del regulador de tensión, independientemente del tipo de conexión o de la tensión nominal del alternador. **Para estos casos, el terminal E2 del regulador de tensión no debe ser utilizado.**



NOTA

Para obtener los diagramas de conexión de los alternadores de la carcasa 400 y mayores, consulte a WEG.



4.8.3 Alternadores trifásicos – 6 terminales – (carcasas 400-450-500-560)

DIAGRAMA DE CONEXIONES		Estrella					Triángulo				
		TENSIÓN (V)									
60Hz	L - L	220	380	440	480	600	127	220	277	346	
	L - N	127	220	254	277	346	-	-	-	-	
	(E1 ou E2) - E3/4 (Referencia)	220 (E1)	380 (E2)	440 (E2)	480 (E2)	600 (E2)	127 (E1)	220 (E1)	277 (E1)	346 (E2)	
50Hz	L - L	190	380	400	415	110	220	230	240		
	L - N	110	220	230	240	-	-	-	-		
	(E1 ou E2) - E3/4 (Referencia)	190 (E1)	380 (E2)	400 (E2)	415 (E2)	110 (E1)	220 (E1)	230 (E1)	240 (E1)		
BORNERA											



ATENCIÓN

- El alternador es suministrado con el regulador de tensión conectado para las características nominales de operación;
- En caso de mantenimiento o alteración de la conexión del alternador, conectar correctamente los cables E1 o E2, E3/4 y 3 en el regulador de tensión (E1 o E2 – E3/4, tensión de referencia) y (3 – E3/4, alimentación de potencia del regulador);
- En alternadores WEG con tensión única (6 o 3 terminales) de 160 a 300V, conectar siempre los cables **E1 – E3/4** del alternador en los terminales **E1** y **E3/4** del regulador de tensión, conforme esquemas arriba;
- En alternadores WEG con tensión única (6 o 3 terminales) de 320 a 600V, conectar siempre los cables **E2 – E3/4** del alternador en los terminales **E2** y **E3/4** del regulador de tensión, conforme esquemas arriba;



NOTA

Para obtener los diagramas de conexión de los alternadores de la carcasa 400 y mayores, consulte a WEG.



4.8.4 Alternadores trifásicos com conexão monofásica – 12 terminales

DIAGRAMA DE CONEXIONES		Monofásico Zig-zag paralelo	Monofásico Zig-zag Série	Monofásico Triângulo
		TENSÃO (V)		
60Hz	L – L	200 - 240	440 - 480	220 - 240
	L – N	100 - 120	220 - 240	100 - 120
	E1 - E3/4	200 - 240	220 - 240	220 - 240
50Hz	L – L	190 - 220	380 - 400	190 - 220
	L – N	95 - 110	190 - 220	95 - 110
	E1 - E3/4	190 - 220	190 - 220	190 - 220
BORNERA		8 pinos	8 pinos	8 pinos
		12 pinos - carcasa 315 – 355	12 pinos - carcasa 315 - 355	12 pinos - carcasa 315 - 355



ATENÇÃO

E1 - E3/4 – Tensão de Referência para el Regulador de Tensión (ver Manual del Regulador de Tensión). Para la conexión monofásica triángulo, los conductores de referencia del regulador (E1 y E3/4) conectados originalmente en los cables principales 7 y 9 y el conductor del bobinado auxiliar (4), conectado originalmente en el cable principal 9, deben ser removidos de su posición original y reconectados de la siguiente forma: cables 4 y E3/4 en el cable principal 8 y el cable E1 en el cable principal 1 (conforme esquemas arriba).

4.8.5 Conexiones del regulador de tensión

Para efectuar correctamente la conexión del alternador con el regulador de tensión, consulte el manual del regulador de tensión:

- El modelo de regulador de tensión utilizado depende de las características del alternador y de la aplicación deseada, siendo así, las conexiones eléctricas con el alternador y la identificación de los terminales pueden diferir de un modelo para otro.
- El manual del regulador de tensión es suministrado junto con el alternador.
- El modelo de alternador estándar es el GTA (con bobina auxiliar y sin excitatriz auxiliar).
- No es recomendado que el alternador modelo GTA funcione sin bobina auxiliar, ya que con esta configuración la alimentación de potencia del regulador de tensión se perjudica en los casos de cortocircuito o sobrecargas. Esta condición solamente es permitida en casos de emergencia, cuando ocurre falla de la bobina auxiliar. Así que sea posible, el alternador deberá ser reparado para mantener las características originales.
- Los alternadores con excitatriz auxiliar (modelo GPA) son especiales y deben ser fabricados bajo consulta a WEG.
- Cuando se utiliza un transformador para adecuación de la tensión de referencia del regulador de tensión, el mismo no podrá ser instalado dentro de la caja de conexión principal del alternador.



4.9 ASPECTOS MECÁNICOS

4.9.1 Bases y fundaciones

- El dimensionamiento de las bases debe ser realizada de forma a conferir rigidez a la estructura, evitándose amplificaciones de los niveles de vibración del conjunto. La base deberá tener su superficie plana contra los pies del alternador de modo que evite deformaciones en la carcasa del alternador.
- La base siempre deberá estar nivelada en relación con el piso. La nivelación es obtenida a través del empleo de calzos entre la base y el piso.

4.9.2 Alineación y nivelación

El alternador debe estar perfectamente alineado con la máquina propulsora, especialmente en los casos de acoplamiento directo.



ATENCIÓN

Una alineación incorrecta puede causar daños en los rodamientos, vibraciones y mismo, fractura del eje.

4.9.2.1 Alternadores con cojinete doble (B35T o B3T)

El alternador debe ser alineado correctamente con la máquina accionada, principalmente cuando sea usado el acoplamiento directo.

Una alineación incorrecta puede resultar en daños a los cojinetes, generar excesivas vibraciones y hasta llevar a la ruptura del eje.

La alineación debe ser hecha de acuerdo con las recomendaciones del fabricante del acoplamiento. Principalmente en acoplamientos directos, los ejes del alternador y de la máquina accionada deben ser alineados axial y radialmente, conforme se muestra en la Figura 4.6 y Figura 4.7.

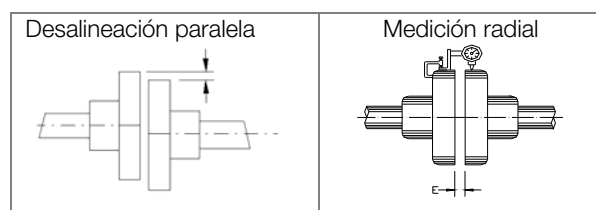


Figura 4.6: Alineación paralela

La Figura 4.6 muestra la desalineación paralela de las 2 puntas de eje y la forma práctica de medición utilizando relojes comparadores adecuados.

La medición es hecha en 4 puntos desplazados 90° entre sí y con los dos medio-acoplamientos girando juntos para eliminar los efectos debido a irregularidades de la superficie de apoyo de la punta del reloj comparador. Eligiendo el punto vertical superior 0°, la mitad de la diferencia de la medición del reloj comparador en los puntos en 0° y 180° representa el error coaxial vertical. En el caso de desvío, este debe ser corregido adecuadamente, agregando o removiendo calces de montaje. La mitad de la diferencia de la medición del reloj comparador en los puntos en 90° y 270° representa el error coaxial horizontal.

Esta medición indica cuándo es necesario izar o bajar el alternador, o moverlo hacia la derecha o hacia la izquierda en el lado accionado para eliminar el error coaxial.

La mitad de la diferencia máxima de la medición del reloj comparador en una rotación completa representa la máxima excentricidad encontrada.

La desalineación en una vuelta completa del eje no puede ser superior a 0,03mm.

Cuando son utilizados acoplamientos flexibles son aceptables valores mayores que los indicados arriba, siempre que no excedan el valor permitido por el fabricante del acoplamiento. Se recomienda mantener un margen de seguridad para estos valores.

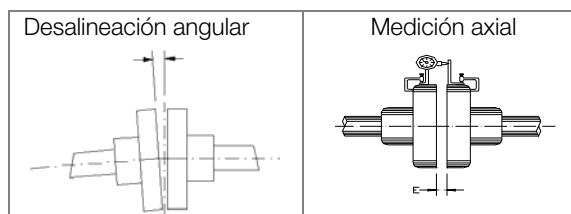


Figura 4.7: Alineación angular

La Figura 4.7 muestra la desalineación angular y la forma práctica para hacer esta medición.

La medición es hecha en 4 puntos desplazados 90° entre sí, con los dos medio-acoplamientos girando juntos para eliminar los efectos debido a irregularidades de la superficie de apoyo de la punta del reloj comparador.

Eligiendo el punto vertical superior 0°, la mitad de la diferencia de la medición del reloj comparador en los puntos en 0° y 180° representa la desalineación vertical.

En el caso de desvío, este debe ser corregido adecuadamente agregando o removiendo calces de montaje debajo de las patas del alternador.

La mitad de la diferencia de la medición del reloj comparador en los puntos en 90° y 270° representa la desalineación horizontal, que debe ser corregido adecuadamente con desplazamiento lateral/angular del alternador.

La mitad de la diferencia máxima de la medición del reloj comparador en una rotación completa representa la máxima desalineación angular encontrada.

La desalineación en una vuelta completa para acoplamiento rígido o semiflexible no puede ser superior a 0,03mm

Cuando son utilizados acoplamientos flexibles, son aceptables valores mayores que los indicados arriba, siempre que no excedan el valor permitido por el fabricante del acoplamiento.

Se recomienda mantener un margen de seguridad para estos valores.

En la alineación/nivelación se debe considerar la influencia de la temperatura sobre el alternador y la máquina accionada. Dilataciones distintas de los componentes pueden alterar el estado de alineación/nivelación durante la operación.

4.9.2.2 Alternadores con cojinete único (B15T)

La base debe ser plana, permitiendo un correcto apoyo del alternador sobre la misma. Siempre que posible, se debe utilizar aisladores de vibración (amortiguadores) entre el conjunto alternador + motor y base con el propósito de minimizar la transmisión de vibración. Cuando no fuere posible el uso de los aisladores entre conjunto y base, se hace necesario utilizar aislador entre base y suelo. Una de las dos configuraciones es



recomendada, bajo posibilidad de haber operación con altos niveles de vibración.

4.9.3 Acoplamiento

4.9.3.1 Alternadores con cojinete doble (B35T/B3T)

4.9.3.1.1 Acoplamiento directo

Se debe preferir siempre el acoplamiento directo, debido al menor costo, reduciendo espacio ocupado, ausencia de deslice (correas) y mayor seguridad contra accidentes. En caso de transmisión con relación de velocidad, es usual también el acoplamiento directo a través de reductores.



ATENCIÓN

Alinear cuidadosamente las puntas de ejes, utilizando acoplamiento flexible, siempre que posible, dejando holgura mínima de 3mm entre los acoplamientos

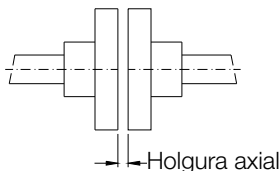


Figura 4.8: Holgura axial

4.9.3.2 Acoplamiento - poleas y correas

Cuando una reducción o aumento de velocidad es necesaria, la transmisión por correa es la más usada. Para evitar esfuerzos radiales innecesarios sobre los cojinetes, los ejes y las poleas tienen que estar perfectamente alineados entre sí. Las correas que trabajan oblicuamente transmiten golpes intermitentes al rotor y podrán dañar los cojinetes. El resbalamiento de la correa podrá ser evitado con aplicación de un material resinoso, como la brea, por ejemplo. La tensión en la correa deberá ser solo lo suficiente para evitar el resbalamiento durante el funcionamiento.



NOTA

Las correas con exceso de tensión aumentan el esfuerzo sobre la punta del eje, causando vibraciones y fatiga, pudiendo llegar a fracturar el eje.

Evite usar poleas demasiado pequeñas, pues estas provocan flexiones en el eje del motor debido a la fuerza de tracción de la correa que aumenta a medida que disminuye el diámetro de la polea.



ATENCIÓN

Los alternadores con cojinetes doble (estándar) son siempre fabricados para aplicaciones con acoplamiento directo. Cuando se utiliza acoplamiento a través de poleas y correas, WEG debe ser siempre consultado para garantizar una aplicación correcta del alternador.



NOTA

Siempre utilizar poleas debidamente balanceadas. Evitar sobras de chavetas, pues estas representan un aumento de la masa de desbalanceado. Si no se observa eso, ocurrirá un aumento en los niveles de vibración.

4.9.3.3 Alternador con cojinete único (B15T)

4.9.3.3.1 Dimensión "G"

Los alternadores salen de la fábrica montados con los discos e bridas de acuerdo con la solicitud del cliente. La dimensión G es la distancia entre la cara externa de los discos en relación con la cara de la brida, de acuerdo con el Figura 4.9.



NOTA

Los alternadores salen de fábrica con la dimensión "G" conforme Tabla 4.9. El montador del grupo alternador tiene la responsabilidad de certificar si la dimensión "G" está de acuerdo con el motor diesel utilizado. Caso la dimensión "G" no sea respectada, podrán ocurrir serios daños al alternador y al motor diesel o, en algunos casos, no será posible acoplar el alternador al motor diesel.

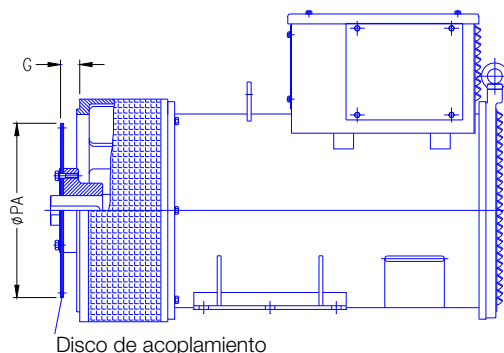


Figura 4.9: G dimensiones

Tabla 4.9: G dimensiones padronizadas

ØPA (mm)	Disco de Acoplamiento (SAE)	G (mm)
241,3	7,5	30,2
263,4	8	61,9
314,2	10	53,9
352,3	11,5	39,6
466,6	14	25,4
517,5	16	15,7
571,4	18	15,7
673,1	21	0,0
733,4	24	0,0

▪ La dimensión ØPA posee una tolerancia de - 0,13mm


NOTAS

El usuario es responsable por la instalación del alternador.

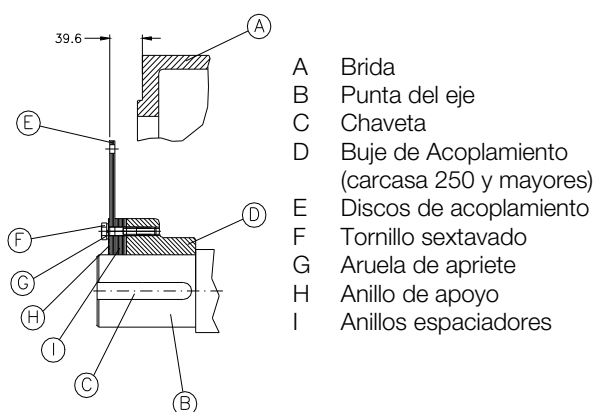
WEG no se responsabiliza por daños al alternador y equipos asociados a instalación, ocurridos debido a:

- Transmisión de vibraciones excesivas;
- Instalaciones precarias;
- Fallas en la alineación;
- Condiciones de almacenamiento inadecuadas;
- No observación de las instrucciones antes del arranque;
- Conexiones eléctricas incorrectas.

4.9.3.3.2 Alteración de la dimensión G

Para cambiar la dimensión “G”, es necesario cambiar la posición de los discos de acoplamiento (E).

Para esto hay que sacar o adicionar los **anillos espaciadores (Letra I)**, conforme indicado en la Figura 4.10.


Figura 4.10: Procedimiento para cambiar la dimensión G

NOTA

Para atender la combinación de brida y disco necesarios, también podrá ser cambiada la brida (A).

Tabla 4.10: Par de apriete para fijación de los discos al eje del alternador con cojinete único

CARCASA	TORNILLOS DE FIJACIÓN (CLASE 10.9)	PAR DE APRIETE
160	6xM12x1,75	119 a 126
200	6xM12x1,75	119 a 126
250	10xM10x1,25	68 a 72
315	12xM12x1,5	119 a 126
355	12xM20x2,50	566 a 595
400	12xM20x2,50	566 a 595

- Para carcasas mayores, consulte la WEG;
- Fijar los tornillos con cola química de alto par.



5 PUESTA EN MARCHA

- El alternador sale de fábrica con el eje trabado o el disco para mejorar la seguridad durante el transporte. Entonces, antes de ponerlo en funcionamiento, estas protecciones deben ser retiradas.
- La conexión de los terminales respecta las características nominales de tarjeta del alternador.
- Para realizar el ajuste de tensión y frecuencia, consulte el manual del regulador de tensión.

5.1 EXAMEN PRELIMINAR

Antes de la puesta en marcha o después de un largo tiempo sin operación, verifique:

1. Si el alternador está limpio y si fueron sacados los materiales de embalaje y los elementos de protección;
2. Si las partes de conexión del acoplamiento están en perfectas condiciones y debidamente apretadas y engrasadas donde necesario;
3. Si el alternador está alineado;
4. Si los cojinetes están debidamente lubricados / o en condiciones de uso;
5. Si están conectados los cables de los protectores térmicos, aterramiento y de las resistencias de calentamiento (cuando hubieren);
6. Si la resistencia de aislamiento de los bobinados tiene el valor prescrito;
7. Si fueron sacados todos los objetos, tais como herramientas, instrumentos de medición y dispositivos de alineamiento de la planta de trabajo del alternador;
8. Si el alternador está correctamente fijado;
9. Si las conexiones eléctricas están de acuerdo con el esquema de conexiones del alternador;
10. Si el regulador de tensión está correctamente conectado, de acuerdo con su manual de instalación;
11. Si los conductores de la red están debidamente conectados a los bornes principales, de modo que no ocurra un cortocircuito o se soltaren;
12. Si el alternador está debidamente aterrado;
13. Gire manualmente el conjunto para verificar si no existe interferencia en el entrehierro. Accionado el alternador en vacío, debe girar levemente y sin ruidos extraños;
14. Si las entradas y salidas de aire se encuentran desobstruidas;
15. Si la dimensión "G" fue respetada (para alternadores con cojinete único).

5.2 OPERACIÓN INICIAL

Além de seguir as instruções de segurança citadas no capítulo 2.2 deste manual, para colocar o alternador em operação pela primeira vez, o seguinte procedimento deverá ser adotado:

- a) Certificar-se de que los terminales del alternador están desconectados de la carga a través del saque de los fusibles en el panel o poner la llave o disyuntor en la posición "abierto";
- b) Caso el alternador tenga resistencia de calentamiento, estas deben estar desenergizadas cuando el alternador estuviere en operación;
- c) Desconectar el regulador de tensión (sacando el fusible en serie con el bobinado auxiliar);



ATENCIÓN

El alternador sale de fábrica con la función U/F constante (del regulador) ajustada, pero como seguridad adicional es recomendable desconectar el regulador.

- d) Girar o conjunto e verificar se não apresenta ruídos estranhos;
- e) Acionar o alternador até a rotação nominal e verificar ruído, vibração e checar todos os dispositivos de proteção;

Después de haber seguido los procedimientos anteriormente descritos y solucionado eventuales problemas ocurridos (ver anomalías - soluciones), desligar el conjunto.

- f) Con el alternador completamente parado, conectar el regulador de tensión, accionar el conjunto y efectuar los ajustes necesarios en el regulador. El manual del regulador describe los procedimientos para los ajustes disponibles (estabilidad, tensión, U/F constante);
- g) Cerrar el disyuntor del circuito principal, aplicar carga y monitorear la corriente del alternador certificándose de que está dentro del especificado;
- h) Verificar los niveles de vibración del conjunto y monitorear los instrumentos de medición (corriente, tensión y frecuencia). Caso haya variación significativa en la vibración del conjunto entre la condición inicial y después de la estabilidad térmica, es necesario hacer un realinamiento / nivelación del conjunto.



ATENCIÓN

Todos los instrumentos de medición y control deberán quedar bajo observación constante a fin de que eventuales alteraciones en la operación puedan ser detectadas y sanadas las causas.

5.3 PARADA

- a) Antes de parar el alternador, abrir el disyuntor del circuito principal para desconectar la carga;
- b) Si el alternador estuviere equipado con resistencia de calentamiento, certifíquese que permanezcan energizadas en cuanto el alternador permanecer parado.





PELIGRO

Mismo después de la desexcitación, aún existe tensión en los terminales de la máquina, por eso solamente después de la parada total del equipamiento es permitido realizar cualquier trabajo.

Constituye peligro de vida no atentarse para el descrito arriba!

5.4 ALTERNADORES EN PARALELO

5.4.1 Entre sí y/o con la red

Condiciones mínimas para funcionamiento de los alternadores, sin incluir controle de la máquina propulsora:

1. El alternador debe tener la misma tensión de operación del otro alternador o de la red;
2. El regulador debe permitir el funcionamiento del alternador en paralelo;
3. Acrecentar un TC de corriente nominal ($I_n/5$) de 5 hasta 10VA en la fase que no es utilizada como referencia para el regulador de tensión y verificar el manual del regulador de tensión;
4. Tener un panel apto para protección y operación de los alternadores;
5. La sincronización y el ajuste de la potencia activa deben ser impuestos por el control de velocidad de las máquinas propulsoras.

Caso aparecieren corrientes elevadas de neutro, utilizar una bobina de aterramiento o abrir la conexión de neutro de uno de los alternadores. Eso ocurre principalmente cuando los alternadores no son iguales o cuando alimentan cargas con elevado contenido de armónicos.



ATENCIÓN

Este tipo de instalación debe ser realizada por equipe técnica especializada;

Para operaciones transitorias en paralelo (ex. rampa de carga) en que el alternador irá operar sencillo después de un período en paralelo, el TC de paralelismo debe ser cortocircuitado, pues este no es necesario en esta operación.



6 MANTENIMIENTO

Los siguientes procedimientos de mantenimiento deberán ser seguidos para asegurar el buen desempeño del equipo. La frecuencia de las inspecciones dependerá esencialmente de las condiciones locales de aplicación y de régimen de trabajo. Si no fuera observado uno de los ítems relacionados a seguir puede significar en reducción de la vida útil del alternador, paradas desnecesarias y / o daños en las instalaciones.

6.1 CONJUNTO DE EMERGENCIA

Los alternadores utilizados en conjuntos de provisión de emergencia deben, conforme el grado de humedad en la planta de instalación, recibir carga de 2 a 3 horas por mes.

6.2 LIMPIEZA

La carcasa, ventanillas, rejas y deflectoras deben ser mantenidas limpias, sin acumulación de aceite o polvo en su parte externa, para facilitar el intercambio de calor con el medio.

También en su interior, los alternadores deben ser mantenidos limpios, exentos de polvo, detritos y aceites. Para limpiarlos, se debe utilizar escobas o paños limpios de algodón. Si el polvo no fuere abrasivo, se debe emplear un chorro de aire comprimido, soplando la suciedad de la tapa deflector y eliminando toda la acumulación de polvo contenido en las palas del ventilador y carcasa.

Los detritos impregnados de aceite o humedad pueden ser limpiados con paños embebidos en solventes adecuados

La caja de conexión debe presentar los terminales limpios, sin oxidación, en perfectas condiciones mecánicas y sin depósitos de grasa o óxido de cobre.

6.3 RUIDO

El ruido en los alternadores deberá ser observado en períodos regulares de 1 a 4 meses. En el caso de anomalía el alternador debe ser parado para investigación de las causas.

6.4 VIBRACIÓN

Nivel de vibración máximo para el alternador en carga: **20mm/s** (RMS).

6.5 RODAMIENTOS

El control de la temperatura en el rodamiento también hace parte del mantenimiento de rutina. La sobre elevación de temperatura no deberá traspasar los 60°C, medido en el anillo externo del rodamiento. La temperatura podrá ser controlada permanentemente con termómetros, puestos en el lado de fuera del cojinete, o con termo-elementos embutidos (opcionales). Las temperaturas de alarma y parada para cojinetes de rodamientos pueden ser ajustadas respectivamente para 110°C y 125°C.

6.5.1 Lubricación

Los alternadores con tamaño de carcasa hasta 315 poseen rodamientos blindados, no siendo necesario efectuar la relubricación de los mismos. Estos deben ser sustituidos cuando alcancen 20.000 horas de trabajo o 30 meses, prevaleciendo lo que ocurra primero.

Para los alternadores de la carcasa 355 y mayores, los rodamientos deben ser relubricados **anualmente** o

conforme los intervalos de lubricación informados en la tabla a seguir, prevaleciendo lo que ocurra primero:

Tabla 6.1: Datos de los rodamientos

Carcasa	Cojinete	Rodamiento	Intervalo de lubricación (horas de operación)	Ctde. grasa (g)
160	LA	6211 2RS	-	-
	LOA	6209 2RS	-	-
200	LA	6313 2RS	-	-
	LOA	6210 2RS	-	-
250	LA	6318 2RS-C3	-	-
	LOA	6214 2RS	-	-
315	LA	6320 2RS-C3	-	-
	LOA	6316 2RS-C3	-	-
355	LA	6322-C3	4.500	60
	LOA	6220-C3	4.500	31
400	LA	6324-C3	4.500	72
	LOA	6226-C3	4.500	46

1) La vida útil estimada para los rodamientos relubricables es de **40.000 horas**

- Para las demás carcasas, consultar WEG.
- LA = Lado Accionado
- LOA = Lado No Accionado

6.5.1.1 Tipo e cantidad de grasa

La relubricación de los cojinetes debe realizarse siempre con la **grasa original**, especificada en la placa de características de los cojinetes y en la documentación del alternador. Los alternadores WEG estándar son suministrados con grasa POLIREX EM 103.



ATENCIÓN

- WEG no recomienda la utilización de grasa diferente de la grasa original del alternador.
- Cuando se abra el cojinete, inyectar la grasa nueva por medio de la engrasadora para expeler la grasa antigua que se encuentra en el tubo de entrada de la grasa y aplicar la grasa nueva en el rodamiento, en el anillo interior y anillo exterior, llenando 3/4 de los espacios vacíos.
- Nunca limpiar el rodamiento con paños a base de algodón, pues pueden soltar hilachas, sirviendo como partícula sólida.
- Es importante realizar una lubricación correcta, es decir, aplicar la grasa correcta y en cantidad adecuada, pues tanto una lubricación deficiente como una lubricación excesiva causan efectos perjudiciales al rodamiento.
- Una lubricación en exceso provoca elevación de temperatura, a causa de la gran resistencia que ofrece al movimiento de las partes rotativas y, principalmente, al batido de la grasa, que termina perdiendo completamente sus características de lubricación.



**NOTA**

WEG no se responsabiliza por el cambio de la grasa o mismo por eventuales daños oriundos del cambio.

6.5.1.2 Instrucciones para lubricación

El sistema de lubricación fue proyectado de forma tal que durante la relubricación de los rodamientos, toda la grasa antigua se retire de las pistas de los rodamientos a través de un drenaje que permite su salida pero impide la entrada de polvo u otros contaminantes nocivos hacia adentro del rodamiento. Este drenaje evita también que se dañen los rodamientos por el conocido problema de relubricación excesiva.

Se recomienda realizar la relubricación con el alternador en operación, para garantizar la renovación de la grasa en el alojamiento del rodamiento.

Si no fuera posible a causa de la presencia de piezas que giran cerca de la engrasadora (poleas, etc.), que pueden ser un riesgo a la integridad física del operador, proceda de la siguiente forma:

- Con el alternador parado, inyectar aproximadamente la mitad de la cantidad total de grasa prevista y arrancar el alternador durante aproximadamente 1 minuto en plena rotación;
- Parar el alternador e inyectar el resto de la grasa. La inyección de toda la grasa con el alternador parado puede causar la penetración de parte del lubricante hacia el interior del alternador a través del sellado interior del anillo del rodamiento.

**ATENCIÓN**

Es importante limpiar los engrasadores antes de la lubricación, para evitar que materiales ajenos se desplacen hacia adentro del rodamiento.

**NOTA**

Los datos de los rodamientos, cantidad y tipo de grasa e intervalos de lubricación están informados en una placa de identificación fijada en el alternador. Verifique estas informaciones antes de realizar la lubricación.

- Los intervalos de lubricación informados en la placa consideran una temperatura de trabajo del rodamiento de 70°C. Con base en los rangos de temperatura de operación listados a continuación, aplique los siguientes factores de corrección para los intervalos de lubricación de los rodamientos:
 - Temperatura de operación inferior a 60°C: 1,59.
 - Temperatura de operación de 70°C a 80°C: 0,63.
 - Temperatura de operación de 80°C a 90°C: 0,40.
 - Temperatura de operación de 90°C a 100°C: 0,25
 - Temperatura de operación de 100°C a 110°C: 0,16.

6.5.1.3 Procedimientos para la relubricación de los rodamientos

1. Retirar la tapa del drenaje;
2. Limpiar con paño de algodón alrededor del orificio de la engrasadora;
3. Con el rotor en operación, inyectar la grasa por medio de engrasadora manual hasta que la grasa empiece a salir por el drenaje o hasta que se haya inyectado la cantidad de grasa informada en la Tabla 6.1.
4. Operar el motor durante el tiempo suficiente para que el exceso de grasa salga por el drenaje;
5. Verifique la temperatura del cojinete para certificarse que no hubo ninguna alteración significativa; Reinstalar nuevamente la tapa del drenaje.

6.5.2 Cambio de los rodamientos**ATENCIÓN**

Por seguridad, el cambio de rodamientos debe ser efectuado con el alternador desacoplado de la máquina propulsora.

6.5.2.1 Alternador con cojinete único - B15T**Carcasa 160 y 200**

1. Poner el alternador en la posición vertical con el lado de los discos de acoplamiento para arriba;
2. Retirar el rotor completo, utilizando un cáncamo que tenga la misma rosca del agujero central de la punta de eje, izando con la utilización de una grúa;
3. Substituir el rodamiento y recolocar el rotor completo, certificando-se que el anillo o ring esté en la posición correcta en el cubo de la tapa trasera.

Carcasa 250

1. Liberar los cables de la excitatriz (F+) e (F-).
2. Retire la tapa y la rejilla trasera para tener acceso al rodamiento y efectuar el cambio.

Carcasas 315 a 400

Para desmontar la parte trasera del alternador y tener acceso al rodamiento, se debe seguir el siguiente procedimiento:

1. Liberar los cables (F+) y (F-) en la caja de conexión;
2. Retirar la rejilla trasera;
3. Liberar los cables del rotor principal conectados en el puente rectificador del rotor de la excitatriz;
4. Retire los tornillos que fijan el rotor de la excitatriz en el eje y retirarlo manualmente;
5. Retirar los tornillos de la tapa trasera, fijada en la carcasa y retirar esta tapa juntamente con el estator de la excitatriz;
6. Sustituir el rodamiento y montar el alternador;

6.5.2.2 Alternador con cojinete doble - B35T

Para efectuar el cambio de los rodamientos en el alternador con cojinete doble, es necesario desmontar el alternador por completo.

6.5.2.3 Sustitución del rodamiento

El desmontaje de los rodamientos no es difícil, desde que sean usadas herramientas adecuadas.



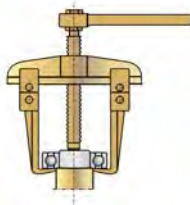


Figura 6.1: Extractor de rodamientos



ATENCIÓN

El rodamiento solamente debe ser sacado del eje del cuando sea absolutamente necesario

Instrucciones:

1. Las garras del extractor deberán ser aplicadas sobre la lateral del anillo interno del rodamiento a ser desmontado, o sobre una pieza adyacente;
2. Antes del montaje de los rodamientos nuevos, los asientos de los ejes deben ser limpiados y levemente lubricados;
3. Los rodamientos deben ser calentados una temperatura de 50°C a 100°C para facilitar el montaje;
4. Los rodamientos no deben ser sometidos a golpes, caídas, almacenaje con vibraciones o humedad, pues pueden provocar marcas en las pistas internas o en las esferas, reduciendo su vida útil;

6.6 MANTENIMIENTO DE LA EXCITATRIZ

6.6.1 Excitatriz

Para el buen desempeño de sus componentes, la excitatriz del alternador debe ser mantenida limpia. Efectúe la limpieza periódica, siguiendo los procedimientos descritos en este manual. Verificar la resistencia de aislamiento de las bobinas de la excitatriz principal y excitatriz auxiliar (si hay) periódicamente para determinar las condiciones de aislamiento de los mismos, siguiendo los procedimientos descritos en este manual.

6.6.2 Prueba en los diodos

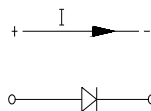
Los diodos son componentes que poseen una gran durabilidad y no exigen test frecuentes. En caso que el generador presente algún defecto que indique falla en los diodos a través del regulador de tensión, o un aumento de la corriente de campo para una misma condición de carga, los diodos deben ser testeados conforme el procedimiento a seguir:

1. Soltar las conexiones de todos los diodos con el bobinado del rotor de la excitatriz;
2. Con un ohmímetro, medir la resistencia de cada diodo en ambas direcciones.



NOTA

Cuando testee los diodos, observe la polaridad de los terminales de test en relación a la polaridad del diodo. La polaridad del diodo es indicada por una seta en la carcasa



La conducción de corriente debe ocurrir solamente en el sentido ánodo-cátodo, o sea, en la condición de polarización directa.

El diodo es considerado bueno cuando presenta baja resistencia óhmica (hasta $\pm 100\Omega$) en su dirección directa y alta resistencia (aprox. $1M\Omega$) en la dirección contraria. Diodos defectuosos tendrán resistencia óhmica de 0Ω o mayor a $1M\Omega$ en ambas direcciones medidas. En la mayoría de los casos, el método con ohmímetro para testear los diodos es suficiente para identificar fallas en los diodos. No obstante, en algunos casos extremos podrá ser necesaria la aplicación de tensión nominal de bloqueo y/o circulación de corriente para detectar falla en los diodos. Debido a los esfuerzos requeridos para estos tests, en caso de duda, se recomienda realizar el cambio de los diodos

6.6.3 Cambio de los diodos

Para tener acceso a los diodos y poder realizar el cambio, es necesario:

- Desmontar el alternador (carcasa 160);
- Retirar la tapa de inspección trasera (carcasa 200);
- Retirar la reja trasera (carcasas 250 hasta 400);
- Para las demás carcasas, consultar WEG.

Para sustituir cualquier diodo, proceda conforme sigue:

- Deshaga la conexión de los 6 diodos con el rotor de la excitatriz;
- Suelte el soporte de diodos del rotor de la excitatriz y retírelo;
- Fije el soporte en un torno de bancada con protección en el mordiente, y retire todos los diodos;
- Instale tres diodos nuevos de misma polaridad (AND o CTD) en uno de los puentes de conexión;
- Instale en la otra ponte de la conexión, tres nuevos diodos de polaridad contraria a la de los tres diodos instalados anteriormente;
- Fije todos los diodos, apretándolos con un torquímetro respetando los torques de apriete de la **Erro! Fonte de referência não encontrada.**;
- Fije el conjunto de diodos en el rotor de la excitatriz;
- Haga las conexiones de los diodos con la bobina del rotor de la excitatriz.



ATENCIÓN

Es de fundamental importancia que el par de apriete indicado sea respetado a fin de que los diodos no sean dañados en el montaje.

Tabla 6.1: Par de apriete de los diodos

Rosca da base do diodo (mm)	Chave do torquímetro (mm)	Torque de aperto (Nm)
M6	11	2
M8	17	4
M12	24	10
M16	32	30



Tabla 6.2: Tabla de diodos utilizados

Carcasa	Designación WEG	Designaciones comerciales	
		Semikron	
160	DS4	AND	SKN26/12
		CTD	SKR26/12
200 - 315	DS6	AND	SKN50/12
		CTD	SKR50/12
355 - 450	DS8	AND	SKN71/12
		CTD	SKR71/12

■ Para las demás carcasas, consultar a WEG

6.6.4 Prueba en el varistor

El varistor es el dispositivo instalado entre los dos puentes de conexión de los diodos y tiene la finalidad de proteger los diodos contra sobretensión.

Para testear las condiciones de funcionamiento del varistor puede ser utilizado un ohmímetro.

La resistencia de un varistor debe ser muy alta (± 20.000 ohms).

En caso de daños verificados en el varistor o si su resistencia es muy baja, éste debe ser sustituido.

6.6.5 Sustitución del varistor

Para sustituir el varistor, WEG recomienda que sean seguidas las siguientes recomendaciones:

1. Substituya el varistor dañado por uno nuevo, idéntico al original, conforme es informado en la Tabla 4.7;
2. Para sustituir el varistor, suelte los tornillos que lo fijan a los puentes de conexión de los diodos;
3. Al remover el varistor, observe atentamente cómo los componentes fueron montados para que el nuevo varistor sea instalado de la misma forma;
4. Antes de montar el nuevo varistor, asegúrese de que todas las superficies de contacto de los componentes estén limpias, niveladas y lisas para así asegurar un perfecto contacto entre ellas;
5. Fije el nuevo varistor apretando los tornillos que lo sujetan a los puentes de conexión, solamente lo suficiente para hacer una buena conexión eléctrica, observe el relleno con silicona en el compartimiento del nuevo condensador.

6.6.6 Prueba en el capacitor

El condensador es el dispositivo instalado entre los dos puentes de conexión de los diodos y tiene la finalidad de proteger los diodos contra sobretensión.

Para testear las condiciones de funcionamiento del condensador puede ser utilizado un multímetro con la función de medición de capacitancia.

La capacitancia medida debe ser conforme la especificación del componente;

En caso de daños verificados en el condensador, o si su capacitancia está por encima de la tolerancia especificada, éste debe ser sustituido.

6.6.7 Sustitución del capacitor

Para sustituir el condensador, WEG recomienda que sean cumplidas las siguientes recomendaciones:

1. Sustituya el capacitor dañado por uno nuevo, idéntico al original, conforme es informado en la Tabla 4.7;
2. Para sustituir el condensador, suelte los tornillos que lo fijan a los puentes de conexión de los diodos.
3. Al remover el condensador, observe atentamente cómo los componentes fueron montados, para que el nuevo condensador sea instalado de la misma forma.
4. Antes de montar el nuevo condensador, asegúrese que los terminales y tornillos de conexión estén limpios, asegurando un perfecto contacto entre ellas.
5. Fije el nuevo condensador apretando los terminales que el lo sujetan a los puentes de conexión, solamente lo suficiente para hacer una buena conexión eléctrica. Observe el relleno con silicona en el compartimiento del nuevo condensador.

6.7 FLUJO DE AIRE

Las entradas y salidas de aire deben ser mantenidas sin obstrucciones a fin de que el cambio de calor sea eficiente. Caso haya deficiencia en el cambio de calor, el alternador irá sobrecalentarse pudiendo dañar su bobinado (quema del alternador).

6.8 REVISIÓN COMPLETA

La periodicidad de las revisiones debe ser definida en función del ambiente donde las máquinas están instaladas. Cuanto más agresivo sea el ambiente (suciedad, aceite, ambiente marino, polvo, etc.) menor deberá ser el espacio de tiempo entre las revisiones.

- Limpiar los bobinados sucios con pincel o escoba.
- Utilizar un paño humedecido en alcohol o en solventes adecuados para remover grasa, aceite y otras suciedades que se hayan adherido sobre el bobinado.
- Hacer el secado con aire seco.
- Pasar aire comprimido a través de los canales de ventilación, en el paquete de chapas del estator, rotor y cojinetes.



NOTA

El aire comprimido siempre debe ser pasado después de la limpieza, nunca antes!

- Drenar el agua condensada;
- Limpiar el interior de las cajas de conexión;
- Hacer medición de la resistencia de aislamiento.



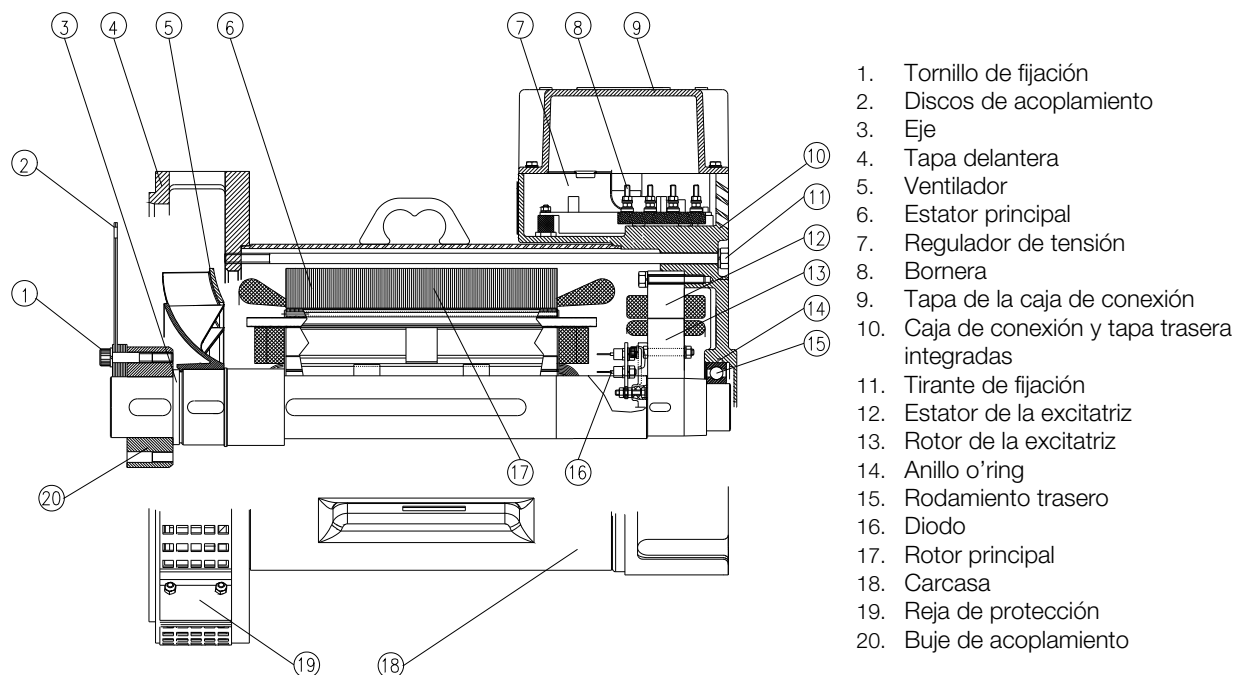
ATENCIÓN

La ausencia de revisiones completas en los alternadores irá a provocar acumulación de suciedad en su interior.

El funcionamiento en estas condiciones podrá reducir la vida útil de la máquina y provocar paradas indeseables y costos adicionales para la recuperación del equipo.



6.9 DESMONTAJE, MONTAJE Y LISTADO DE PIEZAS - GTA160



Desmontaje

Para desmontaje del alternador, coloque el mismo en la posición vertical con el lado de los discos de acoplamiento arriba:

1. Retirar los discos de acoplamiento;
2. Retirar el rotor completo, utilizando un cáncamo que tenga la misma rosca del agujero del centro de la punta de eje, levantando con la utilización de una grúa;
3. Marcar la posición de la brida (4) y de la tapa trasera (10) en relación a la carcasa (17). Así será garantizado el alineamiento original e ideal entre las tres piezas;
4. Colocar el alternador en la posición horizontal sobre una base, de tal manera que los pies y la brida se queden aéreos, suelte los cables de conexión principales del tablero de conexión y los cables del regulador de tensión (7);
5. Retire los tirantes (11) que fijan la tapa trasera y la brida delantera a la carcasa. **Cuando retirar los tirantes, la tapa trasera y la brida estarán sueltas y pueden caer;**
6. Utilizando un martillo de caucho, retire la tapa trasera, certificando-se que los cables de la caja de conexión estén todos liberados evitando así que los mismos sean dañados. De la misma manera retire la brida delantera.



NOTA

Para desmontaje de los alternadores con cojinete doble (forma constructiva B35T) primeramente retire la brida y la tapa delantera.

Montaje

1. Verificar si las partes mecanizadas de encaje de la carcasa, brida y tapa trasera están limpias y con protección anticorrosivo;
2. Con la carcasa en la horizontal sobre una base plana, alinear la marcación de la tapa trasera y de la brida delantera con a marcación de la carcasa y encajarlas, tomando los debidos cuidados con los cables del estator principal y del estator de la excitatriz para no dañarlos;
3. Fijar la brida y la tapa trasera con los tirantes de fijación (11) correspondientes;
4. Colocar el alternador en la posición vertical con el lado de la brida arriba;
5. Insertar el rotor completo en el interior de la carcasa, tomando los debidos cuidados para no dañar las bobinas del rotor de la excitatriz y del rotor principal;
6. Colocar el alternador en la posición horizontal;
7. Asegurar que el rodamiento esté encajado en el asiento y que el anillo o'ring (14) esté en la posición correcta;
8. Hacer las conexiones de los cables principales en el bornera y las conexiones del regulador de tensión;
9. Asegurar que todas las conexiones de los cables principales, regulador de tensión y excitatriz estén correctos.

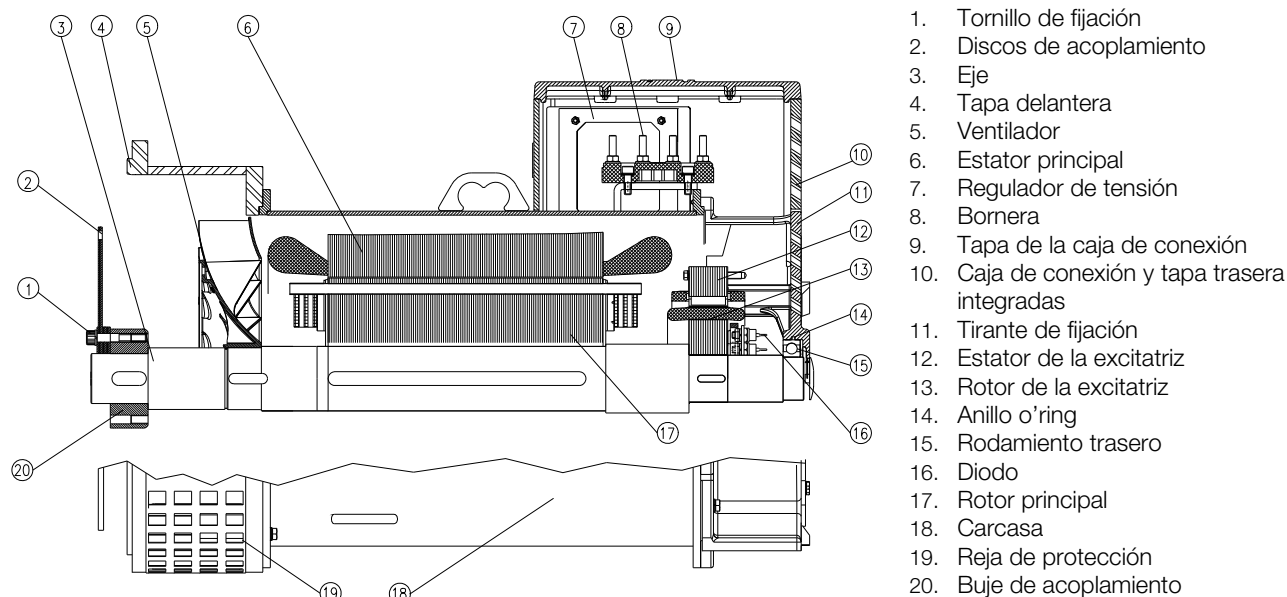


NOTA

- Durante el montaje, los tirantes de fijación deben ser perfectamente alineados para obtener un correcto alineamiento de las partes fijadas.
- Para montaje de los alternadores con cojinete doble (forma constructiva B35T) se debe montar también la tapa y la brida delantera.



6.10 DESMONTAJE, MONTAJE Y LISTADO DE PIEZAS – GTA200



Desmontaje

1. Para desmontaje del alternador, coloque el mismo en la posición vertical con el lado de los discos de acoplamiento arriba;
2. Retirar los discos de acoplamiento;
3. Retirar el rotor completo, utilizando un ojo de terna que tenga la misma rosca del agujero central de la punta del eje, levantando con la utilización de una grúa;
4. Marcar la posición de la tapa trasera (11) en relación a la carcasa (18). Así será garantizado el alineamiento original e ideal entre estas piezas;
5. Colocar el alternador en la posición horizontal sobre una base, de tal manera que los pies y la brida se queden aéreos;
6. Retire la tapa de la caja de conexión (9), soltar los cables de conexión principales del tablero de conexión y los cables del regulador de tensión (7) y de la excitatriz (12);
7. Soltar los tornillos que fijan la caja de conexión (10) en la tapa trasera (11) y la remueva.
8. Retirar los tornillos que fijan la tapa trasera a la carcasa;
9. Utilizando un martillo de caucho, retirar la tapa trasera asegurando que los cables de conexión estén todos liberados evitando así que los mismos sean dañados;
10. De la misma manera, caso sea necesario, retirar la brida delantera (4).



NOTA

Para desmontaje de los alternadores con cojinete doble (forma constructiva B35T) primeramente retirar la brida y la tapa delantera.

Montaje

1. Verificar si las partes mecanizadas de encaje de la carcasa, brida y tapa trasera están limpias y con protección anticorrosivo;
2. Con la carcasa en la horizontal arriba de una base plana, alinear la marcación de la tapa trasera con la marcación de la carcasa y encajarlas, tomando los debidos cuidados con los cables del estator principal y del estator de la excitatriz para no dañarlas;
3. Fijar la tapa trasera con los tornillos de fijación correspondientes;
4. Fijar la caja de conexión en la tapa trasera;
5. Colocar el alternador en la posición vertical con el lado de la brida arriba;
6. Insertar el rotor completo en el interior de la carcasa, tomando los debidos cuidados para no dañar las bobinas del rotor de la excitatriz y del rotor principal;
7. Colocar el alternador en la posición horizontal;
8. Asegurar que el rodamiento esté encajado en el asiento y que el anillo o'ring (14) esté en la posición correcta;
9. Hacer las conexiones de los cables principales en la bornera, y la conexiones del regulador de tensión;
10. Asegurar que todas las conexiones de los cables principales, regulador de tensión y excitatriz estén correctas.

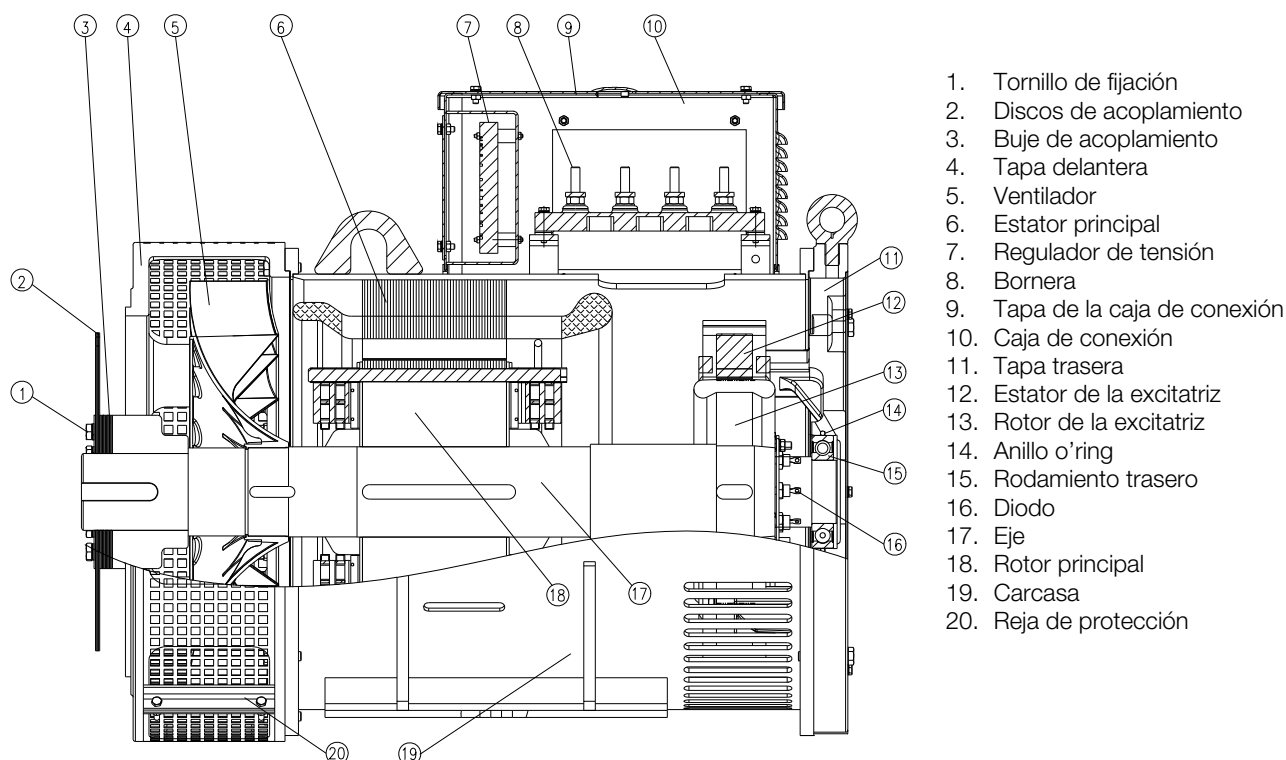


NOTA

Para montaje de los alternadores con cojinete doble (forma constructiva B35T) se debe montar aún la tapa y la brida delanteras.



6.11 DESMONTAJE, MONTAJE Y LISTADO DE PIEZAS – GTA250



Desmontaje

1. Abrir la tapa de la caja de conexión (9) y desconecte los cables del regulador de tensión y de la excitatriz;
2. Soltar los tornillos que fijan la caja de conexión (10) en la carcasa (19) y la sacarla;
3. Retirar la reja de protección (20);
4. Soltar los tornillos que fijan la brida delantera (4) en la carcasa y la sacarla;
5. Retirar las abrazaderas y espiral para liberar los cables del estator principal y de la excitatriz;
6. Soltar los tornillos que fijan la tapa trasera (11) en la carcasa y sacarla, utilizando un martillo de caucho;
7. La retirada del rotor completo debe ser hecha por la delantera del alternador, utilizando dispositivo apropiado.

Montaje

1. Verificar si las partes mecanizadas de encaje de la carcasa, brida y tapa trasera están limpias y con protección anticorrosivo;
2. Insertar el rotor principal por el lado delantero con dispositivo apropiado;
3. Verificar si el anillo o'ring (14) está correctamente colocado en el asiento del rodamiento de la tapa trasera;
4. Encajar la tapa trasera (11) en el rodamiento y fijarla;
5. Colocar la caja de conexión en la posición correcta y fijarla con los tornillos apropiados;
6. Hacer la conexión de los cables del regulador de tensión y de la excitatriz, conforme esquema eléctrico de este manual y manual del regulador de tensión.



NOTA

Para desmontaje de los alternadores con cojinete doble (forma constructiva B35T) primeramente retire la brida y la tapa delantera.

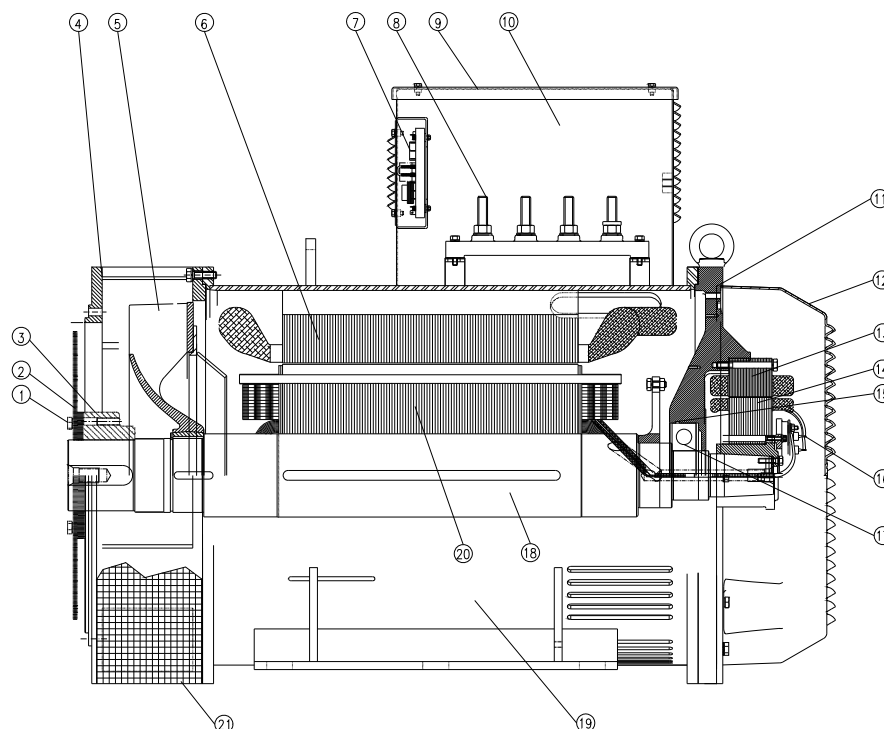


NOTA

Para montaje de los alternadores con cojinete doble (forma constructiva B35T) se debe montar aún la brida y la tapa delantera.



6.12 DESMONTAJE, MONTAJE Y LISTADO DE PIEZAS – GTA250



1. Tornillo de fijación
2. Buje de acoplamiento
3. Discos de acoplamiento
4. Tapa delantera
5. Ventilador
6. Estator principal
7. Regulador de tensión
8. Bornera
9. Tapa de la caja de conexión
10. Caja de conexión
11. Tapa trasera
12. Tapa deflectora
13. Estator de la excitatriz
14. Rotor de la excitatriz
15. Anillo o'ring
16. Diodo
17. Rodamiento trasero
18. Eje
19. Carcasa
20. Rotor principal
21. Reja de protección

Desmontaje

1. Abrir la tapa de la caja de conexión (9) y desconecte los cables del regulador de tensión y de la excitatriz;
2. Soltar los tornillos que fijan la caja de conexión (10) en la carcasa (19) y la sacarla;
3. Retirar la reja de protección (21);
4. Soltar los tornillos que fijan la brida delantera (4) en la carcasa y la saque;
5. Retirar las abrazaderas y espiral para liberar los cables del estator principal y de la excitatriz;
6. Soltar los tornillos y retire la tapa deflectora trasera (12);
7. Soltar los tornillos que fijan el estator de la excitatriz (13) en la tapa trasera y sacarla, utilizando un martillo de caucho y tomando los debidos cuidados para evitar caídas o daños en las bobinas del estator y rotor de la excitatriz;
8. Retirar el rotor de la excitatriz, conforme procedimiento descrito en el ítem 6.13 ;
9. Retirar los tornillos que fijan la tapa trasera (11) en la carcasa y la sacarla con una barra y un martillo de caucho;
10. A retirada do rotor completo debe ser hecha por el lado delantero do alternador, utilizando dispositivo apropiado.

Montaje

1. Verificar si las partes mecanizadas de encaje de la carcasa, brida, tapa trasera y da tapa deflectora están limpias y con protección anticorrosivo;
2. Insertar el rotor principal por el lado delantero con dispositivo apropiado;
3. Verificar se el anillo o'ring (15) está correctamente colocado en el asiento del rodamiento da tapa trasera;
4. Encajar la tapa trasera (11) en el rodamiento y fijela;
5. Encajar manualmente el rotor de la excitatriz en el eje y fijarlo con los tornillos apropiados;
6. Conectar los cables del rotor principal en el puente rectificador del rotor de la excitatriz;
7. Fijar el estator de la excitatriz (13) en la tapa trasera utilizando los tornillos apropiados;
8. Asegurar que los cables de conexión del estator de la excitatriz estén posicionados correctamente para hacer la conexión en la caja de conexión;
9. Fijar la tapa deflectora trasera (12) en la tapa trasera;
10. Fijar la brida delantera (4) en la carcasa;
11. Colocar la reja de protección (21);
12. Coloque la caja de conexión (10) en la posición correcta y fijarla en la carcasa;
13. Hacer la conexión de los cables principales en el bornera y otras conexiones del regulador de tensión y excitatriz, conforme esquema de este manual y manual del regulador de tensión;
14. Fijar la tapa de la caja de conexión (9).

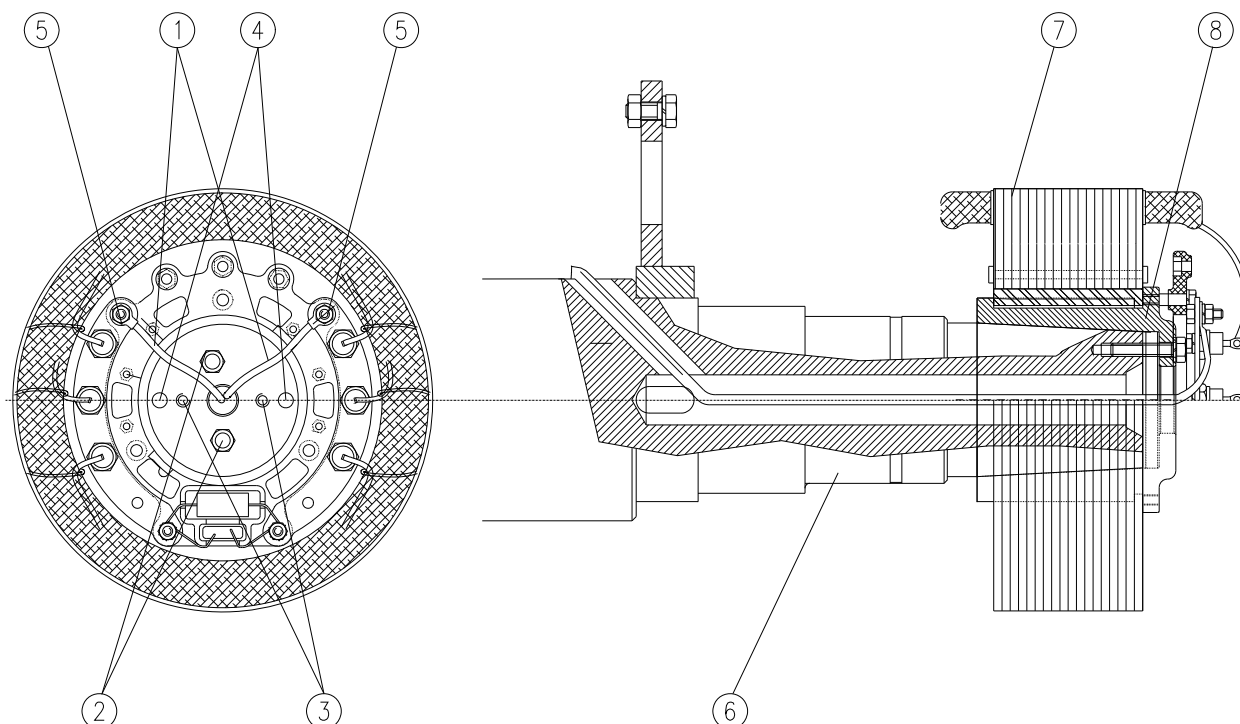


NOTA

- Para desmontaje de los alternadores con cojinete doble (forma constructiva B35T) primeramente retire la brida y la tapa delantera.
- Antes de desmontar los alternadores cerrados tipo GTF se debe retirar el intercambiador de calor instalado en la parte superior de los alternadores.



6.13 DESMONTAJE DEL ROTOR DE LA EXCITATRIZ – GTA315 a GTA400



Procedimiento para sacar el rotor de la excitatriz

1. Retire los tornillos (5) que fijan los cables de conexión del rotor (1) en la rueda de diodos y suelte los cables;
2. Retire la traba mecánica “media luna” de los tornillos de fijación (2);
3. Retire los tornillos de fijación (2) del rotor de la excitatriz;
4. Coloque los 2 tornillos (2) en los agujeros con rosca (3) y apriete los dos tornillos de forma uniforme “simultáneamente” de forma de forzar el aislador de fijación a (8) soltarse del eje (6) hasta que el aislador (8) junto con el rotor de la excitatriz (7) se desprenda y pueda ser retirado con la mano.

6.14 PLAN DE MANTENIMIENTO

Verificaciones y tareas de mantenimiento a ejecutar	Diariamente	En cada 250 h	En cada 1500 h	En cada 4500 h
Observar ruidos extraños con el alternador en movimiento	X			
Inspeccionar la ventilación (flujo de aire)	X			
Verificar resistencia de aislamiento		X		
Verificar y reapretar los tornillos y terminales de conexión		X		
Verificar niveles de vibración y ruido		X		
Inspeccionar los rodamientos		X		
Inspeccionar las conexiones del regulador de tensión		X		
Limpiar el alternador interna y externamente			X	
Inspeccionar el funcionamiento y conexiones de los accesorios			X	
Inspeccionar los diodos rectificadores			X	
Inspeccionar varistores (si hay)			X	
Lubricar los rodamientos ¹				
Cambiar los rodamientos ²				
Revisión completa del alternador				X

1. Verificar el intervalo de lubricación y cantidad de grasa en el ítem 6.5.1 de este manual.

2. El cambio del (s) rodamiento (s) debe ser efectuado en cada 20000 horas..



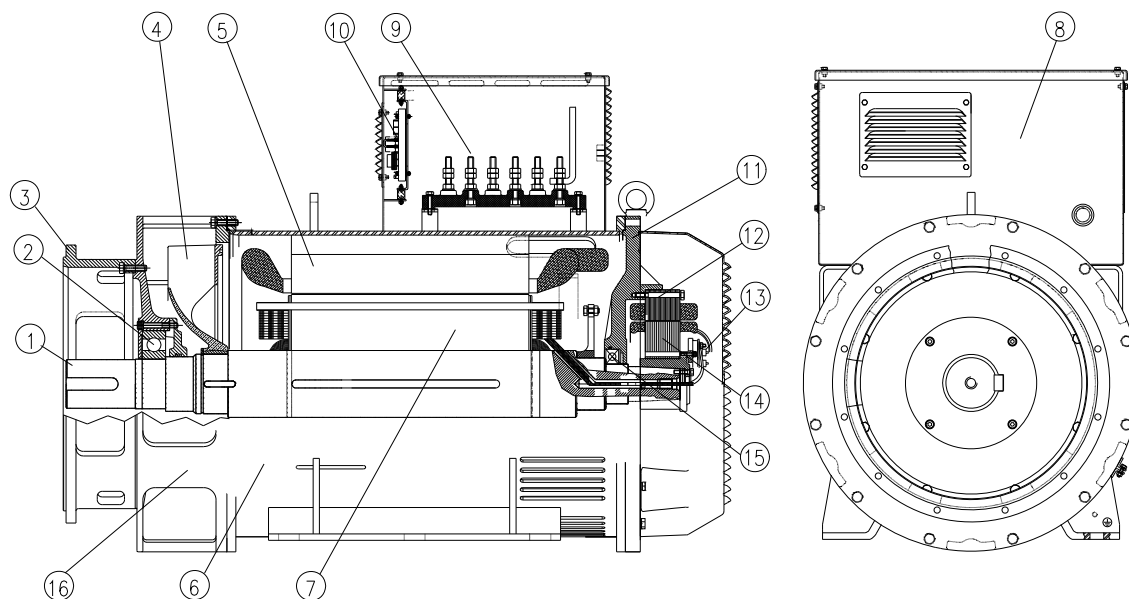
NOTA

Las verificaciones y tareas descriptas en la tabla arriba deben ser ejecutadas conforme ítem 6 de este manual.



7 LISTADO DE PIEZAS (MODELOS ESPECIALES)

7.1 GTA COJINETE DOBLE (B35T)

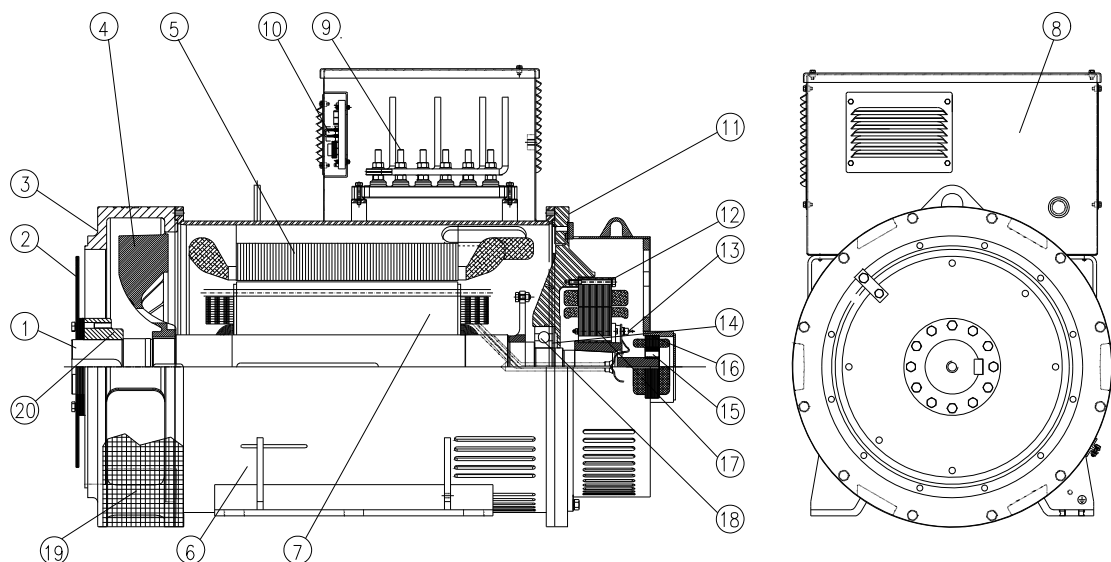


1. Eje
2. Rodamiento delantero
3. Tapa delantera
4. Ventilador
5. Estator principal
6. Carcasa

7. Rotor principal
8. Caja de conexiones
9. Bornera
10. Regulador de tensión
11. Tapa trasera
12. Estator de la excitatriz principal

13. Conjunto de diodos
14. Rodamiento trasero
15. Reja trasera
16. Rotor de la excitatriz
17. Brida

7.2 GPA COJINETE ÚNICO (B15T)



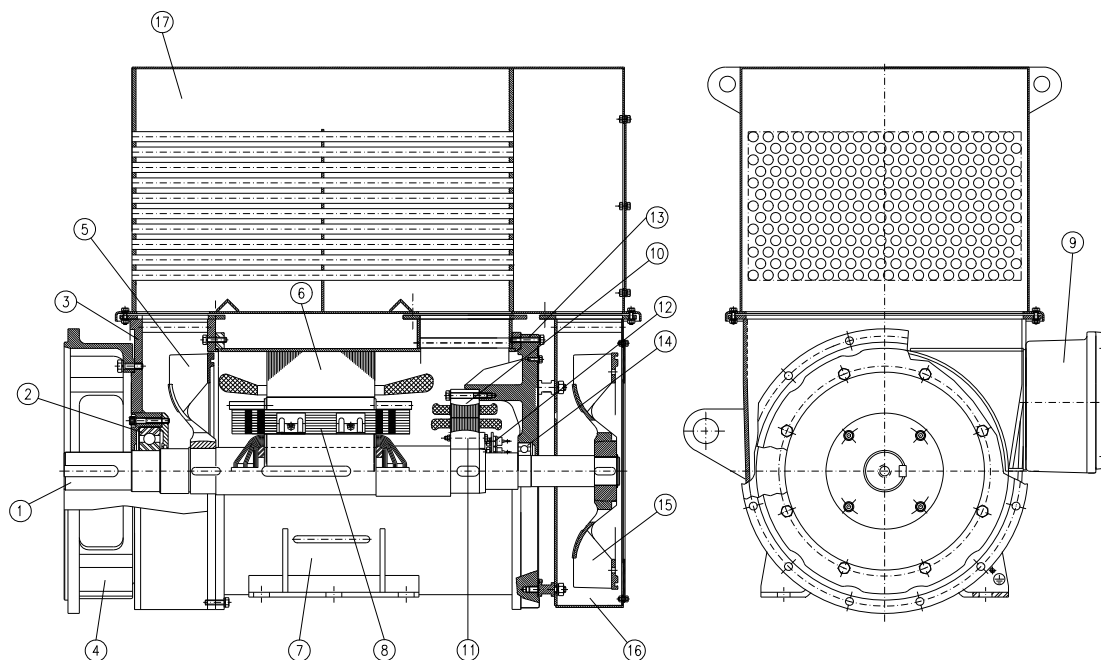
1. Eje
2. Discos
3. Brida
4. Ventilador
5. Estator principal
6. Carcasa
7. Rotor principal

8. Caja de conexiones
9. Bornera
10. Regulador de tensión
11. Tapa trasera
12. Estator de la excitatriz principal
13. Conjunto de diodos
14. Rodamiento trasero

15. Rotor de la excitatriz auxiliar
16. Estator de la excitatriz auxiliar
17. Reja trasera
18. Rotor de la excitatriz
19. Reja de protección
20. Buje de acoplamiento

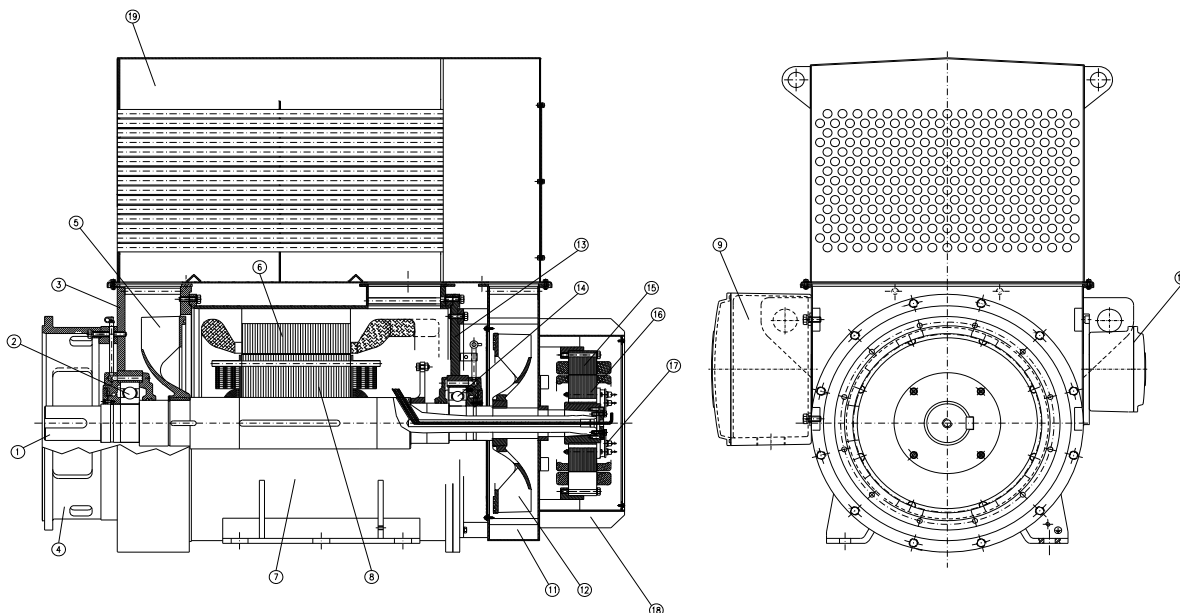


7.3 GTF 200 Y GTF250



1. Eje	7. Carcasa	13. Tapa trasera
2. Rodamiento delantero	8. Rotor principal	14. Rodamiento trasero
3. Tapa delantera	9. Caja de conexiones	15. Ventilador externo
4. Brida	10. Estator de la excitatriz principal	16. Protección del ventilador
5. Ventilador interno	11. Rotor de la excitatriz	17. Intercambiador de calor
6. Estator principal	12. Conjunto de diodos	

7.4 GTF315 A GTF560



1. Eje	8. Rotor principal	14. Rodamiento trasero
2. Rodamiento delantero	9. Caja de conexiones	15. Estator de la excitatriz
3. Tapa delantera	10. Caja de accesorios	16. Rotor de la excitatriz
4. Brida	11. Protección del ventilador	17. Conjunto de diodos
5. Ventilador interno	12. Ventilador externo	18. Soporte de la excitatriz
6. Estator principal	13. Tapa trasera	19. Intercambiador de calor
7. Carcasa		



8 ANOMALÍAS

Enseguida enumeramos algunas anomalías posibles de ocurrir en servicio, bien como el procedimiento correcto para su verificación y corrección.

EL ALTERNADOR NO EXCITA	
ANOMALÍA	PROCEDIMIENTO
Interrupción en el circuito del bobinado auxiliar	Verificar la conexión de los cables del bobinado auxiliar en el bloc de conexión prosiguiendo hasta el bloc de conexión del regulador y fusible;
Fusible quemado	Cambiar el fusible del auxiliar (conforme especificado).
Tensión residual demasiadamente baja.	Desconectar los cables del regulador y hacer excitación externa con batería de 12 a 20Vcc (polo negativo en F- y polo positivo en F+), hasta el inicio del proceso de excitación. La batería de arranque del diesel no deberá estar aterrada.
Velocidad del accionamiento no está correcta.	Medir las rotaciones. Hacer eventualmente, nueva reglaje.
Interrupción en el circuito de excitación principal.	Verificar continuidad de los cables F+ y F-, hacer mediciones en todos los diodos y cambiar los diodos con defecto o cambiar el conjunto todo.
Relé o otro componente del regulador con defecto.	Cambiar el regulador de tensión.
Potenciómetro de ajuste de tensión externa roto o conexión interrumpida.	Verificar las conexiones en los terminales 11-12 y el propio potenciómetro.
Varistor de protección del rotor (cuando hubiere) está con defecto.	Caso estuviere defectuoso, debe ser cambiado, o si no hubiere pieza de reposición, sacarlo temporalmente.

ALTERNADOR NO EXCITA, HASTA LA TENSIÓN NOMINAL	
ANOMALÍA	PROCEDIMIENTO
Rectificadores giratorios defectuosos	Cambiar el conjunto de los diodos
Velocidad incierta	Medir la velocidad de la máquina primaria y regularla
Ajuste abajo de la nominal	Ajustar el potenciómetro en el regulador o el externo
Alimentación del regulador de tensión no está de acuerdo con la tensión de salida deseada	Verificar si las conexiones están de acuerdo con el manual del regulador de tensión.

EN VACÍO, EL ALTERNADOR EXCITA HASTA LA TENSIÓN NOMINAL, PERO ENTRA EN COLAPSO CON CARGA	
ANOMALÍA	PROCEDIMIENTO
Fuerte caída de velocidad	Controlar selector diesel
Diodos giratorios defectuosos	Cambiar el conjunto de diodos



EL ALTERNADOR, EN VACÍO, ES EXCITADO A TRAVÉS DE SOBRE TENSION

ANOMALÍA	PROCEDIMIENTO
Tiristor de potencia del regulador defectuoso	▪ Cambiar el regulador
Transformador de alimentación del regulador con defecto o incorrecto	▪ Verificar relación de tensión / funcionamiento
Alimentación del regulador de tensión no está de acuerdo con la tensión de salida deseada	▪ Rehacer las conexiones. Verificar el manual del regulador de tensión

OSCILACIONES EN LAS TENSIONES DEL ALTERNADOR

ANOMALÍA	PROCEDIMIENTO
Estabilidad mal ajustada	▪ Ajustar en el trimpot estabilidad del regulador
Oscilaciones en la rotación de la máquina de accionamiento	▪ Las oscilaciones frecuentes son originarias de la máquina de accionamiento y necesitan ser eliminadas.

ANOMALÍAS MECÁNICAS

ANOMALÍA	PROCEDIMIENTO
Calentamiento excesivo del cojinete (rodamiento)	▪ Rodamiento con falla, falta de lubricación u holgura axial excesiva
Calentamiento excesivo en la carcasa del alternador	▪ Entrada o salida de aire parcialmente obstruido o el aire caliente está retornando para el alternador, sobrecarga en el alternador o sobreexcitación
Vibración excesiva	▪ Desalineación, defecto de montaje o holgura en el acoplamiento
Caída de tensión acentuada con recuperación posterior guiñada)	▪ Ajuste incorrecto da estabilidad, alternador operando sencillo con sistema de paralelismo conectado o sobrecarga momentánea



ATENCIÓN

Las máquinas referenciadas en este manual experimentan perfeccionamientos constantes, por eso las informaciones contenidas en este manual están sujetas a cambios sin previo aviso.



9 GARANTÍA

Estos productos, cuando son operados en las condiciones estipuladas por WEG en los manuales de operación de cada producto, tienen garantía contra defectos de fabricación y de materiales por un período de doce (12) meses contados a partir del comienzo de operación o dieciocho (18) meses la fecha de fabricación, lo que primero ocurrir.

Entretanto, esta garantía no es aplicada para ningún producto que haya sido sometido a mal uso, mal empleo, negligencia (incluyendo sin limitación, mantenimiento inadecuado, accidente, instalación inadecuada, modificaciones, adaptaciones, reparaciones o cualquier otro caso originado por aplicaciones inadecuadas). La garantía no será responsable por cualquier gasto incurrido en la instalación del comprador, desensamblaje, gastos como perjuicios financieros, transporte y de locomoción, bien como hospedaje y alimentación de los técnicos cuando solicitados por el comprador.

Las reparaciones y/o reemplazo de piezas o componentes, cuando efectuados a criterio de WEG durante el periodo de garantía, no postergará el plazo de garantía original, a menos que sea expresado por escrito por WEG.

Esto constituye la única garantía de WEG con relación a esta venta y la misma substituye todas las demás garantías, expresas o implícitas, escritas o verbales.

No existe ninguna garantía implícita de negociación o conveniencia para una finalidad específica que sea aplicada a esta venta.

Ningún empleado, representante, revendedor u otra persona está autorizado para dar cualquier garantía en nombre de WEG o para asumir por WEG cualquier otra responsabilidad en relación con cualquiera de sus productos.

En caso de que esto ocurra, sin la autorización de WEG, la garantía estará automáticamente anulada.

RESPONSABILIDADES

Excepto lo especificado en el parágrafo anterior denominado "Términos de Garantía Para Productos de Ingeniería", la empresa no tendrá ninguna obligación o responsabilidad para con el comprador, incluyendo, sin limitación, cualquier reclamo con referencia a daños consecuentes o gastos con mano de obra por razón de cualquier violación de la garantía expresa descrita en este fascículo.

El comprador también concuerda en indemnizar y mantener la Compañía libre de daños consecuentes de cualquier causa de acción (excepto gastos de reposición y reparación de productos defectuosos, conforme lo especificado en el parágrafo anterior denominado "Términos de Garantía Para Productos de Ingeniería", consecuente directa o indirectamente de los actos, de negligencia u omisión del comprador con relación a/o proveniente de pruebas, uso, operación, reposición o reparación de cualquier producto descrito en esta cotización y vendido o suministrado por la Compañía al comprador.



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energia@weg.net
www.weg.net



ANOTACIONES

[illegible]

Prezado Cliente,

Obrigado por adquirir o alternador WEG. É um produto desenvolvido com níveis de qualidade e eficiência que garantem um excelente desempenho.

A energia elétrica exerce um papel de relevante importância para o conforto e bem-estar da humanidade. Sendo o alternador responsável pela geração desta energia, este precisa ser identificado e tratado como uma máquina, cujas características envolvem determinados cuidados, dentre os quais os de armazenagem, instalação, operação e manutenção.

Todos os esforços foram feitos para que as informações contidas neste manual sejam fidedignas as configurações e utilização do alternador.

Assim, recomendamos ler atentamente este manual antes de proceder a instalação, operação ou manutenção do alternador para assegurar uma operação segura e contínua do alternador e garantir a sua segurança e de suas instalações. Caso as dúvidas persistam, consultar a WEG.

Mantenha este manual sempre próximo do alternador, para que possa ser consultado sempre que for necessário.



ATENÇÃO

1. É imprescindível seguir os procedimentos contidos neste manual para que a garantia tenha validade;
2. Os procedimentos de instalação, operação e manutenção do alternador deverão ser feitos por pessoas capacitadas.



NOTAS

1. A reprodução das informações deste manual, no todo ou em partes, é permitida desde que a fonte seja citada;
2. Caso este manual seja extraviado, uma cópia em formato eletrônico pode ser obtida no site www.weg.net ou poderá ser solicitada à WEG outra cópia impressa.

WEG EQUIPAMENTOS ELÉTRICOS S.A.





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1 INTRODUÇÃO

Este manual visa atender os alternadores da linha G. Alternadores com especialidades podem ser fornecidos com documentos específicos (desenhos, esquema de ligação, curvas características, etc.). Estes documentos devem ser criteriosamente avaliados juntamente com este manual, antes de proceder a instalação, operação ou manutenção do alternador.

Consultar a WEG caso haja a necessidade de algum esclarecimento adicional. Todos os procedimentos e normas constantes neste manual deverão ser seguidos para garantir o bom funcionamento do alternador e a segurança dos profissionais envolvidos na operação do mesmo. Observar estes procedimentos é igualmente importante para assegurar a validade da garantia do alternador. Assim, recomendamos a leitura minuciosa deste manual antes da instalação e operação do alternador. Caso persistir alguma dúvida, consultar a WEG.



ATENÇÃO

Em caso de troca dos componentes citados neste manual, deverá ser observada a data de fabricação do alternador em relação à data de revisão do manual.

1.1 AVISOS DE SEGURANÇA NO MANUAL

Neste manual são utilizados os seguintes avisos de segurança:



PERIGO

A não consideração dos procedimentos recomendados neste aviso pode ocasionar danos materiais consideráveis, ferimentos graves ou morte.



ATENÇÃO

A não consideração dos procedimentos recomendados neste aviso pode ocasionar danos materiais.



NOTA

O texto com este aviso tem o objetivo de fornecer informações importantes para o correto entendimento e bom funcionamento do produto.



1.2 NOMENCLATURA

	G	T	A	16	1	A	I	SR
LINHA DO ALTERNADOR G - Máquina Síncrona - Linha G								
CARACTERÍSTICA DE EXCITAÇÃO T - Alternador brushless com bobina auxiliar P - Alternador brushless com excitatriz auxiliar (PMG) S - Alternador brushless sem bobina auxiliar e sem excitatriz auxiliar								
TIPO DE REFRIGERAÇÃO A - Aberto autoventilado F - Fechado com trocador de calor ar-ar W - Fechado com trocador de calor ar-água K - Fechado com carcaça aletada								
CARCAÇA - IEC 16 - carcaça 160 20 - carcaça 200 ...								
COMPRIMENTO DA CARCAÇA 1 - Carcaça curta 2 - Carcaça média 3 - Carcaça longa								
TENSÃO A - Trifásico - 12 terminais - 480/240V - 440/220V - 380/190V - 208V (60 Hz) 400/200V - 380/220/190V (50Hz) B - Trifásico - 6 terminais - 220V/60Hz ou 190V/50Hz C - Trifásico - 6 terminais - 380V/60Hz D - Trifásico - 6 terminais - 440V/60Hz ou 380V/50Hz E - Trifásico - 6 terminais - 480V/60Hz ou 400V/50Hz F - Trifásico - 6 terminais - 600V/60Hz ou 575V/60Hz G - Trifásico - 6 terminais - 208V/60Hz H - Trifásico - 6 terminais - 415V/50HZ I - Trifásico - 6 terminais - 2300V/60Hz J - Trifásico - 6 terminais - 4160V/60HZ K - Trifásico - 6 terminais - 6600V/60Hz L - Trifásico - 6 terminais - 13800V/60Hz M - Trifásico - 6 terminais - 3300V/50Hz N - Trifásico - 6 terminais - 6000V/50Hz O - Trifásico - 6 terminais - 11000V/50Hz P - Trifásico - 12 terminais - 415/240/208/120V (50Hz) Z - Outra tensão								
APLICAÇÃO I - Industrial M - Marinizado T - Telecomunicações N - Naval E - Especial								
CÓDIGO COMPLEMENTAR Código referente a potência do alternador								



2 INSTRUÇÕES GERAIS

Profissionais que trabalham com instalações elétricas, seja na montagem, na operação ou na manutenção, deverão ser permanentemente informados e estar atualizados sobre as normas e prescrições de segurança que regem o serviço e são aconselhados a observá-las rigorosamente. Antes do início de qualquer trabalho, cabe ao responsável certificar-se de que tudo foi devidamente observado e alertar os operadores sobre os perigos inerentes à tarefa que será executada. Alternadores deste tipo, quando aplicados inadequadamente ou receberem manutenção deficiente, ou ainda quando receberem intervenção de pessoas não capacitadas pode causar sérios danos pessoais e/ou materiais. Assim, recomenda-se que estes serviços sejam executados sempre por pessoas capacitadas.

2.1 PESSOAS CAPACITADAS

Entende-se por pessoas capacitadas aqueles profissionais que, em função de seu treinamento, experiência, nível de instrução, conhecimentos em normas relevantes, especificações, normas de segurança, prevenção de acidentes e conhecimento das condições de operação, tenham sido autorizadas pelos responsáveis para a realização dos trabalhos necessários e que possam reconhecer e evitar possíveis perigos. Estas pessoas capacitadas também devem conhecer os procedimentos de primeiros socorros e ser capazes de prestar estes serviços, se necessário. Pressupõe-se que todo trabalho de colocação em funcionamento, manutenção e consertos sejam feitos unicamente por pessoas capacitadas.

2.2 INSTRUÇÕES DE SEGURANÇA



PERIGO

Durante a operação, estes equipamentos possuem partes energizadas ou girantes expostas, que podem apresentar alta tensão ou altas temperaturas. Assim a operação com caixas de ligação abertas, acoplamentos não protegidos, ou manuseio errôneo, sem considerar as normas de operação, pode causar graves acidentes pessoais e danos materiais.

Os responsáveis pela segurança da instalação devem garantir que:

- Somente pessoas capacitadas efetuem a instalação e operação do equipamento;
- Estas pessoas tenham em mãos este manual e demais documentos fornecidos com o alternador, bem como realizem os trabalhos observando rigorosamente as instruções de serviço, as normas pertinentes e a documentação específica dos produtos;

O não cumprimento das normas de instalação e de segurança pode anular a garantia do produto. Equipamentos para combate a incêndio e avisos sobre primeiros socorros deverão estar no local de trabalho em lugares bem visíveis e de fácil acesso.

Observar também:

- Todos os dados técnicos quanto às aplicações permitidas (condições de funcionamento, ligações e ambiente de instalação), contidos no catálogo, na documentação do pedido, nas instruções de operação, nos manuais e demais documentações;
- As determinações e condições específicas para a

instalação local;

- O emprego de ferramentas e equipamentos adequados para o manuseio e transporte;
- Que os dispositivos de proteção dos componentes individuais sejam removidos pouco antes da instalação.

As peças individuais devem ser armazenadas em ambientes livres de vibrações, evitando quedas e assegurando que estejam protegidas contra agentes agressivos e/ou coloquem em risco a segurança das pessoas.

2.3 NORMAS

Os alternadores são especificados, projetados, fabricados e testados de acordo com as seguintes normas:

Tabela 2.1 - Normas aplicáveis

	IEC	NBR	ISO
Especificação	60034-1	5117	
Dimensões	60072	5432	
Ensaio	60034-4	5052	
Graus de proteção	60034-5	9884	
Refrigeração	60034-6	5110	
Formas construtivas	60034-7	5031	
Ruído	60034-14	5117	8528

2.4 CARACTERÍSTICAS DO AMBIENTE

Em conformidade com as normas IEC-60034.1 e ABNT 5117, as condições ambientais de funcionamento para as quais os alternadores foram projetados são as seguintes:

1. Temperatura ambiente: -15°C a $+40^{\circ}\text{C}$;
2. Altitude (a.n.m.): até 1000 m;
3. Ambiente sem presença de agentes agressivos, como: maresia, produtos químicos, etc.;
4. Ambientes de acordo com o grau de proteção do alternador.

Condições especiais de ambiente são descritas na placa de características e folha de dados técnicos específica do alternador.



ATENÇÃO

Para utilização dos alternadores com refrigeração à água, em temperaturas abaixo de 0°C devem ser adicionados aditivos anticongelantes na água.



2.4.1 Ambientes agressivos e/ou marinizados

O alternador industrial padrão não deve ser utilizado em ambientes agressivos, pois este estará sujeito a ação de intempéries que podem causar corrosão de partes mecânicas e diminuição da resistência de isolamento dos enrolamentos e como consequência a queima do alternador. Nestas situações, a WEG não se responsabiliza por danos que possam vir a ocorrer no alternador, descaracterizando a garantia do produto conforme termo de garantia WEG.



NOTA

Alternadores aplicados em ambientes agressivos devem ser providos de proteções adicionais contra corrosão e baixa isolamento, assegurando, quando solicitado, a garantia de desempenho do produto.

São considerados ambientes agressivos: ambiente marítimo ou com concentração de salinidade e/ou umidade elevada, materiais em suspensão que possam ser abrasivos, aplicação naval e ambiente com alta variação de temperatura. Nestes casos, deve-se consultar a WEG para uma correta especificação do alternador para a aplicação requerida.

2.5 CONDIÇÕES DE OPERAÇÃO

Para que o termo de garantia do produto tenha validade, o alternador deve operar de acordo com os dados nominais, seguir as normas e códigos aplicáveis e as informações contidas neste manual.





3.2.3.1.1 Armazenagem em ambiente abrigado

- O ambiente deve ser fechado e coberto;
- O local deve estar protegido contra umidade, vapores, agentes agressivos, roedores e insetos;
- Não pode haver a presença de gases corrosivos, como cloro, dióxido de enxofre ou ácidos;
- O ambiente deve estar livre de vibração contínua ou intermitente;
- O ambiente deve possuir sistema de ventilação com filtro de ar;
- Temperatura ambiente entre 5°C e 60°C, não devendo apresentar flutuação de temperatura súbita;
- Umidade relativa do ar <50%;
- Possuir prevenção contra sujeira e depósitos de pó;
- Possuir sistema de detecção de incêndio;
- Deve estar provido de eletricidade para alimentação das resistências de aquecimento (se houver).

Caso algum destes requisitos não seja atendido no local da armazenagem, a WEG sugere que proteções adicionais sejam incorporadas na embalagem do alternador durante o período de armazenagem, conforme segue:

- Caixa de madeira fechada ou similar com instalação elétrica que permita que as resistências de aquecimento (se houver) possam ser energizadas;
- Caso exista risco de infestação e formação de fungos, a embalagem deve ser protegida no local de armazenamento, borrifando-a ou pintando-a com agentes químicos apropriados;
- A preparação da embalagem deve ser feita com cuidado por uma pessoa capacitada.

3.2.3.1.2 Armazenagem em ambiente desabrigado

Não é recomendada a armazenagem do alternador em local desabrigado.

Caso a armazenagem em ambiente desabrigado não puder ser evitada, o alternador deve estar acondicionado em embalagem específica para esta condição, conforme segue:

- Para armazenagem em ambiente desabrigado, além da embalagem recomendada para armazenagem interna, a embalagem deve ser coberta com uma proteção contra poeira, umidade e outros materiais estranhos, utilizando para esta finalidade uma lona ou plástico resistente;
- Posicionar a embalagem sobre estrados ou fundações que garantam a proteção contra a umidade e que impeçam que a mesma afunde no solo;
- Depois que o alternador estiver coberto, um abrigo deve ser erguido para protegê-lo contra chuva direta, neve ou calor excessivo do sol.



ATENÇÃO

Caso o alternador permaneça armazenado por longos períodos, recomenda-se inspecioná-lo regularmente conforme especificado no item **"Plano de manutenção durante a armazenagem"** deste manual.

3.2.3.2 Peças separadas

- Caso tenham sido fornecidas peças separadas (caixas de ligação, tampas etc.), estas peças deverão ser

embaladas conforme especificado nos itens 3.2.3.1.1 e 3.2.3.1.2.

- A umidade relativa do ar dentro da embalagem não deverá exceder 50%.

3.2.3.3 Resistência de aquecimento

As resistências de aquecimento do alternador (se houver) devem permanecer energizadas durante o período de armazenagem para evitar a condensação da umidade no interior do alternador e assim assegurar que a resistência do isolamento dos enrolamentos permaneça em níveis aceitáveis.



ATENÇÃO

As resistências de aquecimento do alternador devem ser ligadas obrigatoriamente quando o mesmo estiver armazenado em local com temperatura < 5°C e/ou umidade relativa do ar > 50%.

3.2.3.4 Resistência de isolamento

Durante o período de armazenagem, a resistência de isolamento dos enrolamentos do estator, rotor e excitatriz do alternador devem ser medidas e registrada a cada três meses e antes da instalação do alternador. Eventuais quedas do valor da resistência de isolamento devem ser investigadas.

3.2.3.5 Superfícies usinadas expostas

Todas as superfícies usinadas expostas (por exemplo, a ponta de eixo, flange, disco de acoplamento) são protegidas na fábrica com um agente protetor temporário (inibidor de ferrugem).

Esta película protetora deve ser reaplicada pelo menos a cada 6 meses ou quando for removida e/ou danificada.

Produtos Recomendados:

Nome: Dasco Guard 400 TX AZ, Fabricante: D.A. Stuart Ltda
Nome: TARP, Fabricante: Castrol.

3.2.3.6 Mancais

3.2.3.6.1 Mancais blindados (carcaça até 315)

Durante o período de armazenagem, a cada dois meses, deve-se retirar o dispositivo de trava do eixo e girá-lo manualmente para distribuir a graxa dentro do rolamento e conservar o mancal em boas condições. Caso o alternador permaneça armazenado por um período maior que 2 anos, os rolamentos deverão ser substituídos.

3.2.3.6.2 Mancais relubrificáveis (carcaça até 355)

Os rolamentos são lubrificados na fábrica para teste. Durante o período de armazenagem, a cada dois meses deve-se retirar o dispositivo de trava do eixo e girá-lo manualmente para conservar o mancal em boas condições. Após 6 meses de armazenagem e antes da entrada em operação, os rolamentos devem ser relubrificados. Caso o alternador permaneça armazenado por um período maior que 2 anos, os rolamentos deverão ser lavados, inspecionados para garantia de sua integridade e relubrificados.





Caso não seja possível girar o eixo do alternador, conforme recomendado, verificar as condições do rolamento antes de colocar o alternador em funcionamento.

Quando a resistência de isolamento dos enrolamentos do alternador for medida, deve-se inspecionar também a caixa de ligação principal e as demais caixas de ligação, considerando especialmente nos seguintes aspectos:

- O interior deve estar seco, limpo e livre de qualquer deposição de poeira;
- Os elementos de contato não podem apresentar corrosão;
- As vedações devem estar em condições apropriadas;
- As entradas dos cabos devem estar corretamente seladas de acordo com o grau de proteção da máquina.

3.2.3.8 Inspeções e registros durante a armazenagem

O alternador armazenado deve ser inspecionado periodicamente e os registros de inspeção devem ser arquivados.

Os seguintes pontos devem ser inspecionados:

1. Danos físicos;
2. Limpeza;
3. Sinais de condensação de água;
4. Condições do revestimento protetivo das partes usinadas;
5. Condições da pintura;
6. Sinais de agentes agressivos;
7. Operação satisfatória das resistências de aquecimento (se houver). Recomenda-se que seja instalado um sistema de sinalização ou alarme no local para detectar a interrupção da energia das resistências de aquecimento;
8. Recomenda-se registrar a temperatura ambiente e umidade relativa ao redor da máquina, a temperatura do enrolamento, a resistência de isolamento e o índice de polarização;
9. Inspeccionar o local de armazenagem para que esteja de acordo com os critérios descritos no item ***"Local de armazenagem"***.

3.2.3.9.1 Limpeza

- O interior e o exterior do alternador devem estar livres de óleo, água, pó e sujeira.
- Remover o inibidor de ferrugem das superfícies expostas com um pano embebido em solvente a base de petróleo;
- Certificar-se que os mancais e cavidades utilizadas para lubrificação estejam livres de sujeira e corretamente seladas.

Em alternadores com mancais relubrificáveis, relubrificar os mancais utilizando o lubrificante especificado. As informações dos mancais e lubrificantes, assim como o procedimento para lubrificação, estão indicadas no item ***“Manutenção dos Mancais”*** deste manual.

Antes de colocar o alternador em operação, deve-se medir a resistência de isolamento dos enrolamentos, conforme item “**Resistência de Isolamento**” deste manual.

Seguir os demais procedimentos descritos no item **Comissionamento** deste manual antes de colocar o alternador em operação.



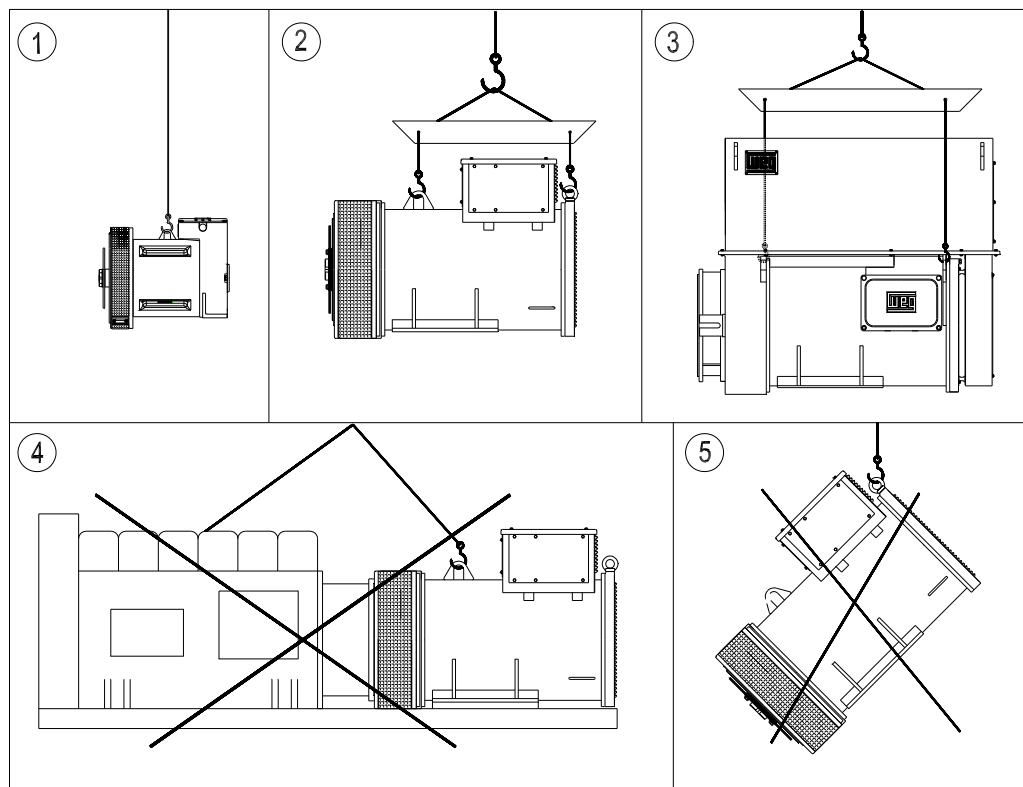
3.2.3.10 Plano de manutenção durante a armazenagem

Durante o período de armazenagem, a manutenção do alternador deverá ser executada e registrada de acordo com o plano descrito na Tabela 3.1.

Tabela 3.1 - Plano de armazenagem

	Mensal	A cada dois meses	A cada seis meses	A cada 2 anos	Antes de entrar em operação	NOTA!
Local de Armazenagem						
Inspecionar as condições de limpeza		X			X	
Inspecionar as condições de umidade e temperatura		X				
Verificar sinais de agentes agressivos		X				
Medir nível de vibração	X					
Embalagem						
Inspecionar danos físicos			X			
Inspecionar a umidade relativa no interior		X				
Trocar o desumidificador na embalagem (se houver)			X			Quando necessário
Resistência de aquecimento (se houver)						
Verificar as condições de operação	X					
Alternador completo						
Realizar limpeza externa			X		X	
Realizar limpeza interna					X	
Verificar as condições da pintura			X			
Verificar o inibidor de oxidação nas partes expostas			X			Repor o inibidor, caso necessário
Enrolamentos						
Medir resistência de isolamento		X			X	
Medir índice de polarização		X			X	
Caixas de ligação e terminais de aterramento						
Limpar o interior das caixas de ligação				X	X	
Inspecionar as vedações				X	X	
Reapertar os terminais de ligação					X	Conforme torques de aperto informados neste manual
Mancais de rolamento relubrificáveis						
Girar o eixo do alternador		X				
Relubrificar o mancal			X		X	
Desmontar, limpar, inspecionar e relubrificar o mancal				X	X	Se o período de armazenagem for maior que 2 anos
Mancais de rolamento blindados						
Girar o eixo do alternador		X				
Substituir o rolamento				X		





4 INSTALAÇÃO

4.1 LOCAL DE INSTALAÇÃO

Os alternadores devem ser instalados em locais de fácil acesso, que permitam a realização de inspeções periódicas, de manutenções locais e, se necessário, a remoção dos mesmos para serviços externos.

As seguintes características ambientais devem ser asseguradas:

- Os alternadores devem receber ar fresco e limpo e o local de instalação deve permitir a fácil exaustão do ar do ambiente de operação do equipamento, evitando recirculação do ar;
- Deve ser evitado que o alternador aspire a fumaça do escapamento do motor diesel, pois a fuligem é condutora elétrica e reduz a vida útil do isolamento podendo provocar a queima do alternador;
- A instalação de outros equipamentos ou paredes não deve dificultar ou obstruir a ventilação do alternador;
- O espaço ao redor e acima do alternador deve ser suficiente para manutenção ou manuseio do mesmo;
- O ambiente deve estar de acordo com o grau de proteção do alternador.



NOTA

Para alternadores com mancal único, o dispositivo de travamento do eixo (utilizado para proteção do conjunto rotor/estator contra danos durante o transporte), deve ser retirado somente pouco antes de acoplá-lo à máquina acionante.

4.2 SENTIDO DE ROTAÇÃO

Os alternadores da linha G padrão podem operar em ambos os sentidos de rotação.

A sequência de fases está ajustada para o sentido de **rotação horário** (visto de frente para a ponta de eixo do alternador - Lado Acionado).

Os terminais dos alternadores estão marcados de tal forma que a sequência dos terminais 1, 2 e 3 coincide com a sequência de fases R, S e T ou L1, L2 e L3, quando o sentido de rotação é horário.

No caso de alternadores que necessitem operar no sentido **anti-horário**, a sequência das fases deve ser alterada (se preciso). Recomenda-se verificar o sentido de rotação e a sequência das fases necessária antes da entrada em operação do alternador.



ATENÇÃO

A sequência de fases errada pode ocasionar danos aos equipamentos alimentados pelo alternador. No caso de operação em paralelo com outros alternadores e/ou com a rede, estes devem possuir a mesma sequência de fases.

4.3 GRAU DE PROTEÇÃO

É de fundamental importância, para o bom desempenho do alternador e para sua durabilidade, que seja observado o grau de proteção deste equipamento em relação ao ambiente de instalação. O alternador padrão da linha G possui grau de proteção IP21 (protegido contra penetração de corpos sólidos de dimensões acima de 12 mm e contra respingos de água na vertical).

4.4 REFRIGERAÇÃO

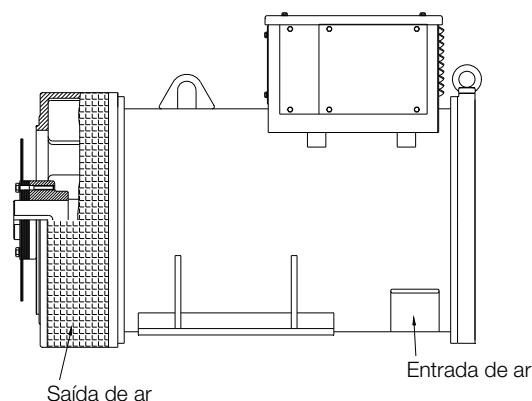


Tabela 4.1 - Sistema de refrigeração

O ventilador está instalado no lado acionado, junto ao rotor. O ar entra pelo lado não acionado e sai pelas aberturas radiais existentes na tampa/flange do lado acionado.



4.5 RESISTÊNCIA DE ISOLAMENTO

4.5.1 Instruções de segurança



PERIGO

Antes de fazer a medição da resistência de isolamento, o alternador deve estar parado e desconectado da carga e o regulador de tensão desconectado. O enrolamento em teste deve ser conectado a carcaça e a terra por um período até remover a carga eletrostática residual. A não observação destes procedimentos pode resultar em danos pessoais.

4.5.2 Considerações gerais

Quando o alternador não é colocado imediatamente em serviço, deve-se protegê-lo contra umidade, temperatura elevada e sujeira, evitando assim, que a resistência de isolamento sofra com isso.

A resistência de isolamento dos enrolamentos deve ser medida antes da entrada em serviço.

Se o ambiente for muito úmido, é necessária uma verificação periódica durante a armazenagem. É difícil prescrever regras fixas para o valor real da resistência do isolamento de uma máquina, uma vez que ela varia com as condições ambientais (temperatura, umidade), condições de limpeza da máquina (pó, óleo, graxa, sujeira) e qualidade e condições do material isolante utilizado.

A avaliação dos registros periódicos de acompanhamento é útil para concluir se o motor está apto a operar.



NOTA

A resistência do isolamento deve ser medida utilizando um **MEGÔHMETRO**.

4.5.3 Medição no enrolamento do estator

A tensão de teste para os enrolamentos do estator dos alternadores deve ser conforme Tabela 4.2 de acordo com a norma IEEE43.

Tabela 4.2 - Tensão para medição da resistência de isolamento

Tensão nominal do enrolamento (V)	Teste de resistência de isolamento Tensão contínua (V)
< 1000	500
1000 - 2500	500 - 1000
2501 - 5000	1000 - 2500
5001 - 12000	2500 - 5000
> 12000	5000 - 10000

Antes de fazer a medição no enrolamento do estator, verificar o seguinte:

- Se todos os cabos da carga estão desconectados;
- Se o regulador de tensão está desconectado.
- Se a carcaça do alternador e os enrolamentos não medidos estão aterrados;
- Se a temperatura do enrolamento foi medida;
- Se todos os sensores de temperatura estão aterrados.

A medição da resistência de isolamento dos enrolamentos do estator deve ser feita na caixa de ligação principal.

O medidor (megôhmetro) deve ser conectado entre a carcaça do alternador e o enrolamento. A carcaça deve ser aterrada e as 3 fases do enrolamento do estator permanecem conectadas no ponto neutro, conforme figura abaixo:

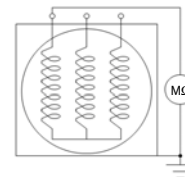


Figura 4.1 - Medição nas 3 fases

Quando possível cada fase deve ser isolada e testada separadamente. O teste separado permite a comparação entre as fases. Quando uma fase é testada, as outras duas fases devem ser aterradas no mesmo aterramento da carcaça, conforme figura abaixo.

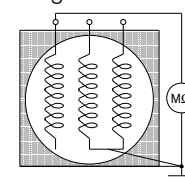


Figura 4.2 - Medição em fases separadas

4.5.4 Medição no enrolamento do rotor, excitatriz e acessórios

Medição no enrolamento do rotor:

- Desconectar os cabos do rotor do conjunto de diodos;
- Conectar o medidor de resistência de isolamento (megôhmetro) entre o enrolamento do rotor e o eixo do alternador. A corrente da medição não pode passar pelos mancais.

Medição do enrolamento do estator da excitatriz principal.

- Desconectar os cabos de alimentação da excitatriz;
- Conectar o medidor de resistência de isolamento (megôhmetro) entre o enrolamento do estator da excitatriz (terminais I e K) e a carcaça do alternador.

Medição no enrolamento do rotor da excitatriz principal:

- Desconectar os cabos do rotor da excitatriz do conjunto de diodos;
- Conectar o medidor de resistência de isolamento (megôhmetro) entre o enrolamento do rotor e o eixo do alternador. A corrente da medição não pode passar pelos mancais.

Medição do enrolamento do estator da excitatriz auxiliar (PMG) – alternadores modelo GP-- :

- Desconectar os cabos que ligam a excitatriz auxiliar ao regulador de tensão;
- Conectar o medidor de resistência de isolamento (megôhmetro) entre o enrolamento do estator da excitatriz auxiliar e a carcaça do alternador.





ATENÇÃO

A tensão do teste para o rotor, excitatriz principal, excitatriz auxiliar e resistência de aquecimento deve ser 500Vcc e demais acessórios 100Vcc. Não é recomendada a medição de resistência de isolamento de protetores térmicos.

Em máquinas que já estão em operação, podem ser obtidos valores superiores de resistência de isolamento, comparados aos valores iniciais de comissionamento. A comparação com valores obtidos em ensaios anteriores na mesma máquina, em condições similares de carga, temperatura e umidade serve como uma melhor indicação das condições da isolação do que o valor obtido num único ensaio, sendo considerada suspeita qualquer redução brusca.

Tabela 4.3 - Limites orientativos da resistência de isolamento em máquinas elétricas

Valor da resistência do isolamento	Avaliação do isolamento
2MΩ ou menor	Perigoso
< 50MΩ	Ruim
50...100MΩ	Regular
100...500MΩ	Bom
500...1000MΩ	Muito Bom
> 1000MΩ	Ótimo

4.5.5 Resistência de isolamento mínima

- Se a resistência de isolamento medida for menor do que 100 MΩ a 40°C, os enrolamentos devem ser cuidadosamente inspecionados, limpos e, se necessário, secados de acordo com o procedimento abaixo antes da máquina entrar em operação:
- Desmontar o alternador retirando o rotor e os mancais;
- Colocar os componentes que possuem enrolamento com baixa resistência de isolamento em uma estufa e aquecer a uma temperatura de 130°C, permanecendo nesta temperatura por pelo menos 08 horas.
- Verificar se a resistência de isolamento alcançada está dentro de valores aceitáveis, conforme Tabela 4.3, caso contrário, consultar a WEG.

4.5.6 Índice de polarização

O índice de polarização é tradicionalmente definido pela relação entre a resistência de isolamento medida em 10 min. e a resistência de isolamento medida em 1 min. com temperatura relativamente constante. Através do índice de polarização podem-se avaliar as condições do isolamento do alternador conforme Tabela 4.4.

Tabela 4.4 - Índice de polarização (relação entre 10 e 1 minuto)

Índice de polarização	Avaliação do isolamento
1 ou menor	Perigoso
< 1,5	Ruim
1,5 a 2,0	Regular
2,0 a 3,0	Bom
3,0 a 4,0	Muito Bom
> 4,0	Ótimo



PERIGO

Imediatamente após a medição da resistência de isolamento, aterre o enrolamento para evitar acidente.

4.5.7 Conversão dos valores medidos

Se o ensaio for feito em temperatura diferente, será necessário corrigir a leitura para 40°C, utilizando-se uma curva de variação da resistência do isolamento em função da temperatura, levantada com a própria máquina. Se não se dispõe desta curva, pode-se empregar a correção aproximada fornecida pela curva da Figura 4.3, conforme NBR 5383 / IEEE43

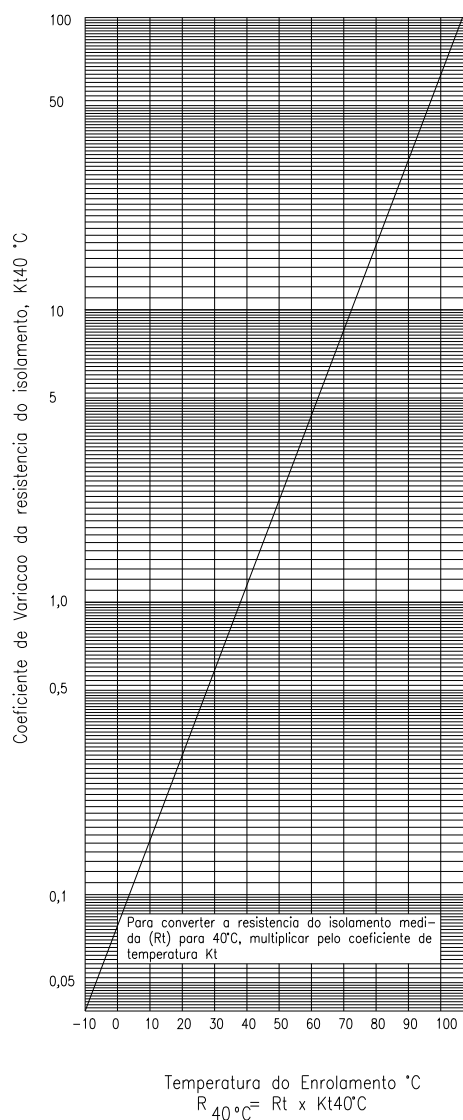


Figura 4.3 - Coeficiente de variação da resistência de isolamento com a temperatura



4.6 PROTEÇÕES

4.6.1 Proteções térmicas

Os alternadores possuem, quando solicitados pelo cliente, dispositivos de proteção contra sobre elevação de temperatura, instalados nas bobinas do estator principal e/ou mancais, conforme segue:

Termostato (bimetálico) - Detectores térmicos do tipo bimetálico, com contatos de prata normalmente fechados que se abrem quando atingem a temperatura de atuação. Os termostatos podem ser ligados em série ou independentes conforme esquema de ligação.

Termistores (tipo PTC ou NTC) - Detectores térmicos, compostos de semicondutores que variam sua resistência bruscamente ao atingirem a temperatura de atuação. Os termistores podem ser ligados em série ou independentes conforme esquema de ligação.



NOTA

Os termostatos e os termistores deverão ser conectados a uma unidade de controle que interromperá o funcionamento do alternador ou acionará um dispositivo de sinalização.

Termoresistência (RTD) - É um elemento de resistência calibrada. Seu funcionamento baseia-se no princípio de que a resistência elétrica de um condutor metálico varia linearmente com a temperatura. Os terminais do detector devem ser ligados a um painel de controle, que inclui um medidor de temperatura.



NOTA

As termoresistências tipo RTD permitem o monitoramento da temperatura absoluta. Com esta informação, o relé poderá efetuar a leitura da temperatura, como também a parametrização para alarme e desligamento conforme as temperaturas pré-definidas.

A fórmula a seguir serve para converter o valor da resistência ôhmica medida para temperatura das termoresistências tipo Pt 100.

$$\text{Fórmula: } \frac{\Omega - 100}{0.386} = ^\circ\text{C}$$

Onde: Ω = resistência ôhmica medida no PT-100

Os dispositivos de proteção, quando solicitados, estão relacionados no esquema de ligação específico de cada alternador. A não utilização destes dispositivos é de total responsabilidade do usuário, porém pode ocasionar a perda de garantia no caso de danos.

4.6.1.1 Limites de temperatura para os enrolamentos

A temperatura do ponto mais quente do enrolamento deve ser mantida abaixo do limite da classe térmica do isolamento. A temperatura total é composta pela soma da temperatura ambiente com a elevação de temperatura (ΔT), mais a diferença que existe entre a temperatura média do enrolamento e a ponto mais

quente do enrolamento. A temperatura ambiente por norma é de, no máximo, 40°C. Acima desse valor, as condições de trabalho são consideradas especiais. A Tabela 4.5 mostra os valores numéricos e a composição da temperatura admissível do ponto mais quente do enrolamento.

Tabela 4.5 - Classe de isolamento

Classe de isolamento		F	H
Temperatura ambiente	°C	40	40
T = elevação de temperatura (método da resistência)	°C	105	125
Diferença entre o ponto mais quente e a temperatura média	°C	10	15
Total: temperatura do ponto mais quente	°C	155	180



ATENÇÃO

Caso o alternador trabalhe com temperaturas do enrolamento acima dos valores limites da classe térmica, a vida útil do isolamento e, consequentemente, a do alternador, se reduz significativamente, ou até mesmo pode ocasionar a queima do alternador.

4.6.1.2 Proteções térmicas para os mancais

Os sensores de temperatura instalados nos mancais (quando houver) servem para protegê-los de danos devido a operação com sobretemperatura.

4.6.1.3 Temperaturas para alarme e desligamento

As temperaturas de alarme e desligamento devem ser parametrizadas o mais baixo possível. Estas temperaturas podem ser determinadas baseando-se nos resultados de testes ou através da temperatura de operação do alternador.

A temperatura de alarme pode ser ajustada para 10°C acima da temperatura de operação do alternador a plena carga considerando a maior temperatura ambiente do local. Os valores de temperatura ajustadas para desligamento não devem ultrapassar as temperaturas máximas admissíveis conforme Tabela 4.6 e Tabela 4.7.

Tabela 4.6: Temperatura máxima do estator - regime contínuo

ENROLAMENTO DO ESTATOR		
Classe de Isolação	Temperaturas máximas de ajuste das proteções (°C)	
	Alarme	Desligamento
F	140	155
H	155	180



ATENÇÃO

Alternadores aplicados em sistemas de emergência (standby) podem ter elevação de temperatura até 25°C acima da temperatura em operação contínua, conforme norma Nema MG-1-22.40 e MG-1-22.84. A utilização do alternador nestas condições reduz a vida útil do alternador.



Tabela 4.7 - Temperatura máxima dos mancais

MANCAIS	
Temperaturas máximas de ajuste das proteções (°C)	
Alarme	Desligamento
110	120



ATENÇÃO!

Os valores de temperatura para alarme e desligamento podem ser definidos em função da experiência, porém não devem ultrapassar aos valores máximos indicados nas tabelas Tabela 4.6 e Tabela 4.7.

4.6.2 Resistência de aquecimento

Quando o alternador encontra-se equipado com resistência de aquecimento para impedir a condensação de água durante longos períodos sem operação, estas devem ser programadas para serem sempre energizadas logo após o desligamento do alternador e serem desenergizadas antes que o alternador entre em operação.

O desenho dimensional e uma placa de identificação específica existente no alternador indicam o valor da tensão de alimentação e a potência das resistências instaladas.



ATENÇÃO

Caso as resistências de aquecimento fiquem energizadas enquanto a máquina estiver em operação, o bobinado poderá ser danificado.

4.6.3 Proteção da bobina auxiliar

O alternador possui um fusível de proteção, ligado em série com a bobina auxiliar ou no regulador de tensão, com a função de protegê-la contra sobrecorrente.



ATENÇÃO

A não utilização do fusível especificado poderá acarretar a queima da bobina auxiliar e, conseqüentemente, da bobinagem do estator. Este defeito não é coberto pela garantia.

No caso de atuação do fusível é necessário substituí-lo por outro de igual valor, a fim de que o alternador opere devidamente protegido.

O fusível protege o alternador e o regulador de tensão nas seguintes situações:

1. Perda de referência (realimentação) do regulador de tensão;
2. Ligação dos cabos da bobina auxiliar em curto-circuito, realizada nos próprios cabos de saída da bobina ou através de ligação errada no regulador de tensão;
3. Ligação dos terminais de saída do regulador de tensão em curto circuito;
4. Operação com baixa rotação (usado para esquentar o motor diesel), principalmente com a função U/F do regulador de tensão desabilitada, dependendo da

condição de operação (rotação, ajuste do regulador e outros);

5. No caso de danos no regulador de tensão (queima do elemento de potência ou falha de referência interna nos circuitos de comparação).

O fusível não atua no caso de curto-circuito das fases do alternador. Nestes casos, a proteção deve ser feita com relé, permitindo a partida de motores e a sensibilização da proteção.

4.6.4 Proteções dos diodos

Os diodos possuem proteção contra sobre tensão e/ou surto de tensão, conforme Tabela 4.8.

Em caso de falha destes componentes, os mesmos devem ser substituídos.

Tabela 4.8: Proteções dos diodos

	Varistor	Capacitor
GTA161 - GTA252	✓	
GTA311 - GTA561	✓	✓
Tipo de montagem	THT	THT
Item (WEG)	10049848	10391625
Características	1W, 745Vcc, 550Vca 210J/2ms	0,1µf, 2000Vcc, 630Vca

4.6.5 Proteções no regulador de tensão

4.6.5.1 Proteção contra subfrequência

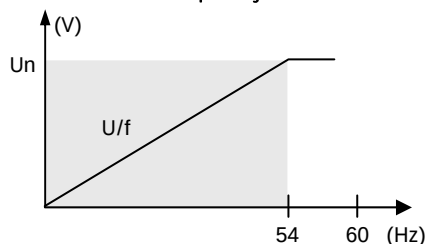
Para colocar do alternador em operação, a proteção contra subfrequência do regulador de tensão deve ser regulada para 90% da frequência nominal (já sai ajustada da fábrica) ou permanecer com o regulador de tensão desligado até o grupo atingir a rotação nominal, evitando assim sobrecorrentes nos enrolamentos da bobina auxiliar e excitação do alternador.



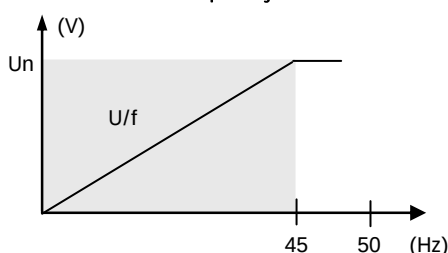
NOTA

As demais proteções do regulador de tensão estão descritas no manual específico do mesmo.

Aplicação 60HZ



Aplicação 50HZ



4.7 REGULADOR DE TENSÃO

O regulador eletrônico de tensão tem por finalidade manter a tensão do alternador constante, independente da carga.

Pode estar montado na caixa de ligação do alternador ou no painel de comando.



ATENÇÃO

Verificar no **Manual do regulador de tensão** os terminais e esquema de ligação e os trimpots para ajuste.

Uma ligação errada pode significar a queima do regulador e/ou de enrolamentos do alternador. Defeitos ocasionados por este motivo não são cobertos pela garantia.

Para maiores detalhes técnicos do funcionamento, funções, conexões, ajustes, anomalias, etc., consultar o manual específico do regulador de tensão.

4.7.1 Manutenção da corrente de curto-circuito

Os alternadores WEG da linha G são fabricados com a bobina auxiliar inserida nas ranhuras do estator principal, isolada do enrolamento principal. Esta bobina tem por função alimentar o circuito de potência do regulador de tensão e manter a corrente de curto-circuito do alternador.



NOTA

1. Devido ao fato do alternador manter alta I_{cc} , deve ser instalado um relé de sobrecorrente para abrir o disjuntor principal em no máximo 20s, sob pena de queima do alternador.
2. Para manutenção da corrente de curto circuito acima de $3,0 \times I_n$, consultar a WEG.



4.8 ASPECTOS ELÉTRICOS

4.8.1 Conexões elétricas

As conexões elétricas do alternador são de responsabilidade do usuário final e devem ser feitas por pessoas capacitadas. Os esquemas de conexão constam no item 4.8.2.

4.8.1.1 Conexão principal

As conexões dos cabos principais devem ser feitas de acordo com os esquemas constantes neste manual, utilizando torque de aperto conforme Tabela 4.9 para fixação dos cabos.

Tabela 4.9 - Torque de aperto dos parafusos dos terminais para fixação dos cabos principais

Diâmetro da Rosca	Torque de aperto (Nm)
M5	5-6
M8	20-25
M10	39-49
M12	64-84
M16	165-206

- Certificar-se que a seção e isolamento dos cabos de ligação estão apropriadas para a corrente e tensão do alternador;
- Antes de efetuar as conexões elétricas entre o alternador e a carga ou rede de energia, é necessário que seja feita uma verificação cuidadosa da resistência de isolamento do enrolamento, conforme Tabela 4.3.

4.8.1.2 Aterramento

Os alternadores devem ser sempre aterrados com um cabo de seção adequada, utilizando o terminal localizado em um dos pés dos mesmos.

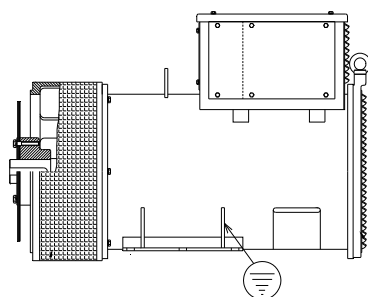


Figura 4.4 – Aterramento

4.8.1.3 Regulador eletrônico de tensão

O regulador eletrônico sai de fábrica conectado eletricamente e ajustado para os valores de tensão e frequência nominais do alternador. Para alteração nas conexões ou ajustes, consultar o manual do regulador de tensão.



ATENÇÃO

Quando houver mudança nas conexões dos terminais principais do alternador para mudança de tensão, deve ser feita também a alteração de conexões dos cabos da tensão de referência do regulador conforme o esquema específico.

Para alterar a frequência de operação do regulador de tensão, consultar o manual do mesmo.

4.8.1.4 Identificação de terminais

Terminais principais (cabos de ligação das fases do estator)
1 a 12, N

Terminais para ligação no regulador de tensão

E1 ou E2 (marrom) - Realimentação de tensão monofásica.

E3/4 (verde) - Comum de alimentação do circuito de potência e da realimentação monofásica do regulador de tensão.

R (azul), **S** (cinza) e **T** (laranja) - realimentação de tensão trifásica.

3 (amarelo) - Alimentação do circuito de potência do regulador de tensão.

F+ (vermelho) e **F-** (preto) - Campo da excitatriz principal

AX1 (azul), **AX2** (cinza) e **AX3** (laranja) - excitatriz auxiliar - alimentação do circuito de potência do regulador de tensão - modelo GPA.

N (branco) - Realimentação de tensão monofásica (GPA)

Terminais dos acessórios

16 a 19 - Resistências de aquecimento

20 a 35 - Termosensores no estator (PT100)

36 a 51 - Termistores no estator (PTC)

52 a 67 - Termostatos no estator

68 a 71 - Termoresistências nos mancais

72 a 75 - Termistores nos mancais

76 a 79 - Termostatos nos mancais

80 a 82 - Dínamos taquimétricos

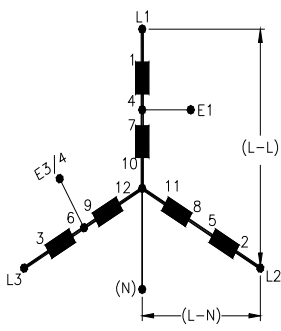
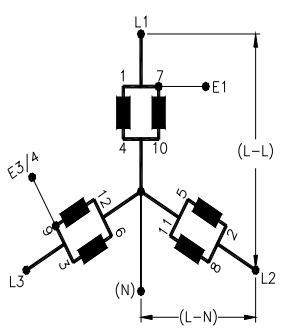
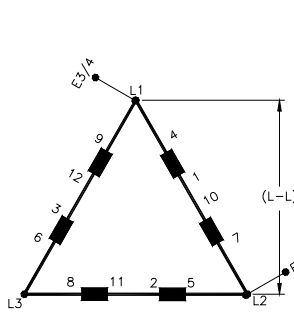
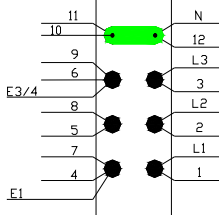
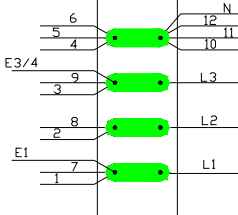
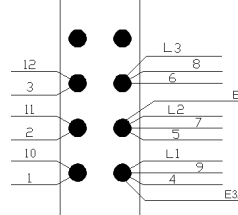
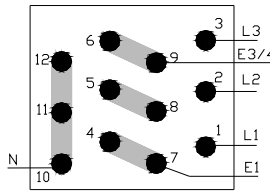
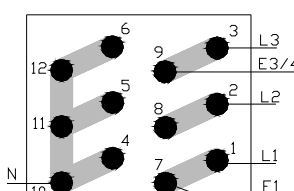
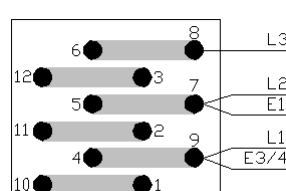
88 a 91 - Termômetros

94 a 99 - Transformadores de Corrente



4.8.2 Diagramas de conexão

4.8.2.1 Alternadores trifásicos - 12 terminais - (carcaças 160 a 355)

ESQUEMA DE LIGAÇÃO		Estrela Série (acesso ao neutro)		Estrela Paralelo (acesso ao neutro)		Triângulo Série	
							
		TENSÃO (V)					
60Hz	L - L	380 - 415	440 - 480	190-208	220 - 240	220 - 240	
	L - N	220 - 240	254 - 277	110-120	127 - 139	-	
	E1 - E3/4 (Referência)	190 - 207	220 - 240	190-208	220 - 240	220 - 240	
50Hz	L - L	380 - 400		190 - 200		200 - 220	
	L - N	220 - 230		110 - 115		-	
	E1 - E3/4 (Referência)	190 - 200		190 - 200		200 - 220	
PLACA DE BORNES	8 pinos		8 pinos		8 pinos		
							
	12 pinos - carcaça 315 - 355		12 pinos - carcaça / 315 - 355		12 pinos - carcaça / 315 - 355		
							



ATENÇÃO

- O alternador é fornecido com o regulador de tensão conectado para as características nominais de funcionamento;
- Em caso de manutenção ou alteração das conexões do alternador, checar os cabos E1, E3/4 e 3 no regulador de tensão (E1 – E3/4, tensão de referência) e (3 – E3/4, alimentação de potência do regulador);
- Em alternadores com 12 terminais, conectar sempre os cabos E1 – E3/4 do alternador nos terminais E1 e E3/4 do regulador de tensão, independente do tipo de conexão ou da tensão nominal do alternador. **Para estes casos, o terminal E2 do regulador de tensão não deve ser usado.**

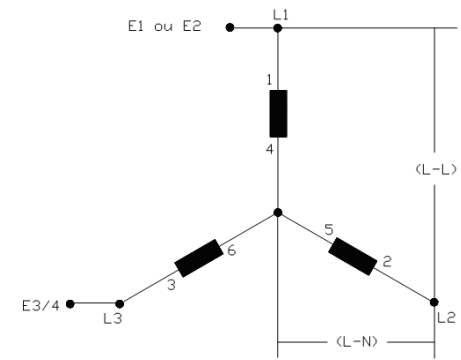
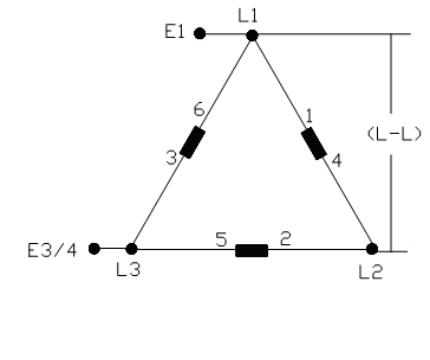
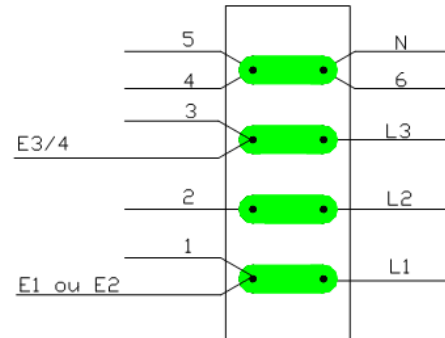
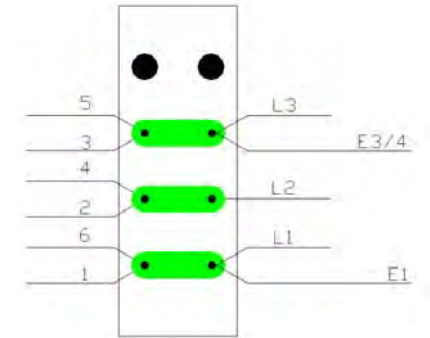


NOTA

Para obter os diagramas de ligação dos alternadores da carcaça 400 e maiores, consultar a WEG.



4.8.2.2 Alternadores trifásicos – 6 terminais (carcaças 160 a 355)

ESQUEMA DE LIGAÇÃO		Estrela						Triângulo			
											
		TENSÃO (V)									
60Hz	L - L	220	380	440	480	600	127	220	277	346	
	L - N	127	220	254	277	346	-	-	-	-	
	(E1 ou E2) - E3/4 (Referência)	220 (E1)	380 (E2)	440 (E2)	480 (E2)	600 (E2)	127 (E1)	220 (E1)	277 (E1)	346 (E2)	
50Hz	L - L	190	380	400	415		110	220	230	240	
	L - N	110	220	230	240		-	-	-	-	
	(E1 ou E2) - E3/4 (Referência)	190 (E1)	380 (E2)	400 (E2)	415 (E2)		110 (E1)	220 (E1)	230 (E1)	240 (E1)	
PLACA DE BORNES		8 pinos						8 pinos			
											



ATENÇÃO

- O alternador é fornecido com o regulador de tensão conectado para as características nominais de funcionamento;
- Em caso de manutenção ou alteração da ligação do alternador, ligar corretamente os cabos E1 ou E2, E3/4 e 3 no regulador de tensão (E1 ou E2 – E3/4, tensão de referência) e (3 – E3/4, alimentação de potência do regulador);
- Em alternadores WEG com tensão única (6 ou 3 terminais) de 160 a 300V, conectar sempre os cabos **E1** – **E3/4** do alternador nos terminais **E1** e **E3/4** do regulador de tensão, conforme esquemas acima;
- Em alternadores WEG com tensão única (6 ou 3 terminais) de 320 a 600V, conectar sempre os cabos **E2** – **E3/4** do alternador nos terminais **E2** e **E3/4** do regulador de tensão, conforme esquemas acima.

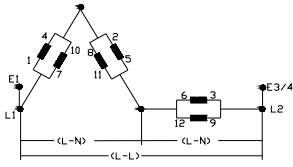
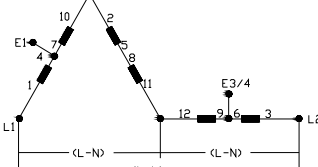
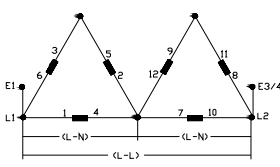
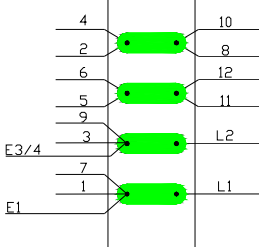
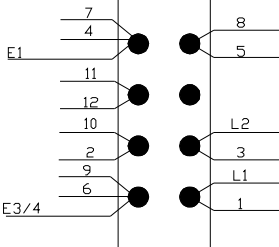
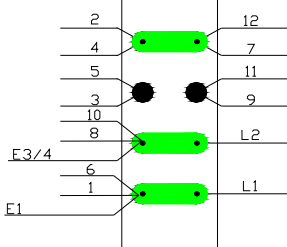
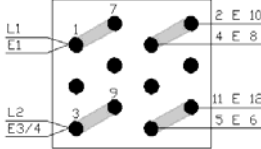
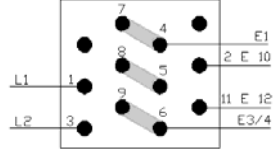
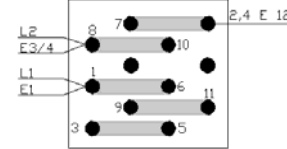


NOTA

Para obter os diagramas de conexão dos alternadores da carcaça 400 e maiores, consultar a WEG.



4.8.2.3 Alternadores trifásicos com ligação monofásica – 12 terminais

ESQUEMA DE LIGAÇÃO		Monofásico Zig-zag paralelo	Monofásico Zig-zag Série	Monofásico Triângulo
				
		TENSÃO (V)		
60Hz	L – L	200 - 240	440 - 480	220 - 240
	L – N	100 - 120	220 - 240	100 - 120
	E1 - E3/4	200 - 240	220 - 240	220 - 240
50Hz	L – L	190 - 220	380 - 400	190 - 220
	L – N	95 - 110	190 - 220	95 - 110
	E1 - E3/4	190 - 220	190 - 220	190 - 220
PLACA DE BORNES		8 pinos	8 pinos	8 pinos
				
		12 pinos - carcaça 315 - 355	12 pinos - carcaça 315 - 355	12 pinos - carcaça 315 - 355
				



ATENÇÃO

E1 - E3/4 – Tensão de referência para o regulador de tensão (Ver manual do regulador de tensão).
Para a conexão monofásico triângulo, os cabos de referência do regulador (E1 e E3/4) ligados originalmente nos cabos 7 e 9 e o cabo da bobina auxiliar (4) que está ligado no terminal 9, devem ser removidos da posição original e reconectados da seguinte forma: cabos 4 e E3/4 no cabo principal 8 e o cabo E1 no cabo principal 1 (conforme esquemas acima).

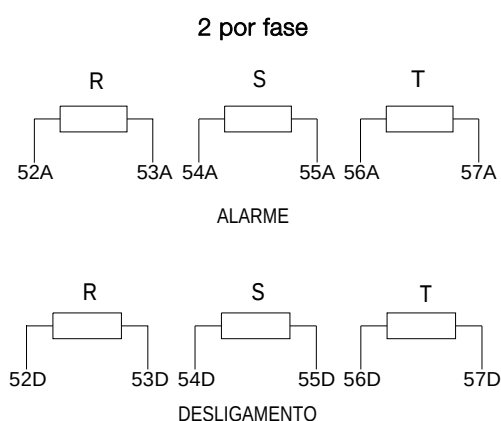
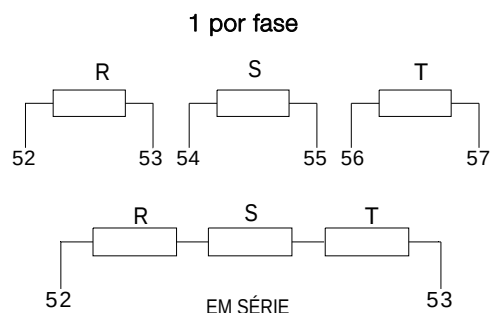
4.8.2.4 Conexões elétricas do regulador de tensão

- Para efetuar corretamente as conexões elétricas do alternador com o regulador de tensão, consultar o manual do regulador de tensão.
- O modelo de regulador de tensão utilizado depende das características do alternador e da aplicação desejada, sendo assim, as conexões elétricas com o alternador e a identificação dos terminais podem diferir de um modelo para outro.
- O manual do regulador de tensão é fornecido juntamente com o alternador.
- O modelo de alternador padrão da linha G é o GTA (com bobina auxiliar e sem excitatriz auxiliar).
- Não é recomendado que o alternador modelo GTA funcione sem bobina auxiliar, pois com esta configuração a alimentação de potência do regulador de tensão fica prejudicada nos casos de curto-circuito ou sobrecargas. Esta condição somente é permitida em casos emergenciais quando ocorrer falha da bobina auxiliar. Assim que possível, o alternador deve ser consertado para manter as características originais.
- Os alternadores com excitatriz auxiliar (modelo GPA) são especiais e devem ser fabricados sob consulta à WEG.
- Quando se utiliza transformador para adequação da tensão de referência do regulador de tensão, este transformador não pode ser instalado dentro da caixa de ligação principal do alternador.

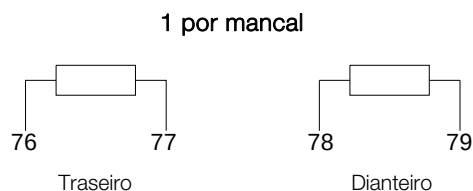


4.8.3 Diagramas de conexão dos acessórios

4.8.3.1 Termostatos no estator

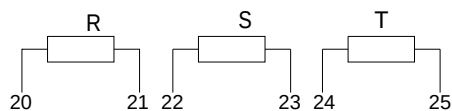


4.8.3.2 Termostatos nos mancais

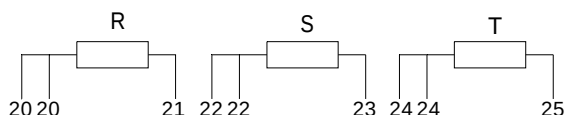


4.8.3.3 Termoresistências no estator

1 por fase

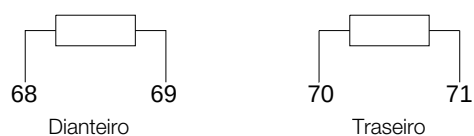


1 por fase (3 fios)

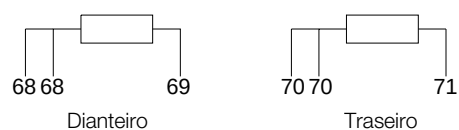


4.8.3.4 Termoresistências nos mancais

1 por mancal



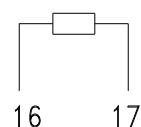
1 por mancal (3 fios)



ATENÇÃO

1. A identificação dos terminais dos sensores tipo PTC consta no item 4.8.1.4.
2. Quando da utilização de 2 sensores por fase são acrescidos os sufixos A para alarme e D para desligamento.

4.8.3.5 Resistências de aquecimento



4.9 ASPECTOS MECÂNICOS

4.9.1 Bases e fundações

- O dimensionamento das bases deve ser realizado de modo a conferir rigidez a estrutura, evitando amplificações dos níveis de vibração do conjunto. A base deverá ter superfície plana contra os pés do alternador de modo a evitar deformações na carcaça do mesmo.
- A base sempre deverá estar nivelada em relação ao solo (piso). O nivelamento é obtido através da colocação de calços entre base e piso.

4.9.2 Alinhamento e nivelamento

O alternador deve estar perfeitamente alinhado com a máquina acionante, especialmente nos casos de acoplamento direto.



ATENÇÃO

Um alinhamento incorreto pode causar defeito nos rolamentos, vibrações e mesmo, ruptura do eixo.

4.9.2.1 Alternadores com mancal duplo (B35T ou B3T)

O alternador deve ser corretamente alinhado com a máquina acionante particularmente em casos de acoplamento direto.

Um alinhamento incorreto pode causar defeito nos mancais, vibrações e até mesmo, ruptura do eixo. O alinhamento deve ser feito de acordo com as recomendações do fabricante do acoplamento. É necessário fazer o alinhamento paralelo e angular do alternador, conforme Figura 4.5 e Figura 4.6.

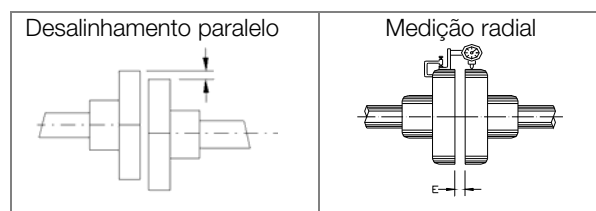


Figura 4.5 - Alinhamento paralelo

A Figura 4.5 mostra o desalinhamento paralelo das 2 pontas de eixo e a forma prática de medição utilizando relógios comparadores adequados. A medição é feita em 4 pontos a 90°, com os dois meio-acoplamentos girando juntos de forma a eliminar os efeitos devido a irregularidades da superfície de apoio da ponta do relógio comparador. Escolhendo o ponto vertical superior 0°, metade da diferença da medição do relógio comparador nos pontos 0° e 180° representa o erro coaxial vertical. Isto deve ser corrigido adequadamente acrescentando-se ou retirando-se calços de montagem. Metade da diferença da medição do relógio comparador nos pontos 90° e 270° representa o erro coaxial horizontal. Desta forma obtém-se a indicação de quando é necessário levantar ou abaixar o alternador ou movê-lo para a direita ou para a esquerda no lado acionado para eliminar o erro coaxial. Metade da diferença máxima da medição do relógio

comparador em uma rotação completa representa a máxima excentricidade.

A máxima excentricidade permitida, para acoplamento rígido ou semi-flexível é 0,03mm.

Quando são utilizados acoplamentos flexíveis, valores maiores que os indicados acima são aceitáveis, mas não deve exceder o valor fornecido pelo fabricante do acoplamento. Recomenda-se manter uma margem de segurança nestes valores.

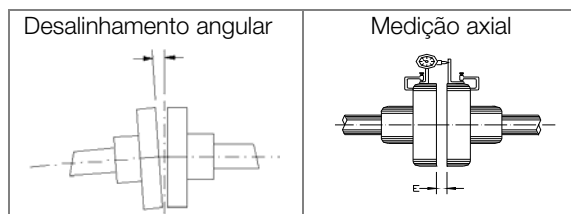


Figura 4.6 - Alinhamento angular

A Figura 4.6 mostra o desalinhamento angular e a forma prática de medição

A medição é feita em 4 pontos a 90°, com os dois meio-acoplamentos girando juntos de forma a eliminar os efeitos devido a irregularidades da superfície de apoio da ponta do relógio comparador. Escolhendo o ponto vertical superior 0°, metade da diferença da medição do relógio comparador nos pontos 0° e 180° representa o desalinhamento vertical. Isto deve ser corrigido adequadamente acrescentando-se ou retirando-se calços de montagem.

Metade da diferença da medição do relógio comparador nos pontos 90° e 270° representa o desalinhamento horizontal. Isto deve ser corrigido adequadamente com movimentos lateral/angular do alternador.

Metade da diferença máxima da medição do relógio comparador em uma rotação completa representa o máximo desalinhamento angular.

O máximo desalinhamento permitido, para acoplamento rígido ou semi-flexível é 0,03mm

Quando são utilizados acoplamentos flexíveis, valores maiores que os indicados acima são aceitáveis, mas não deve exceder o valor fornecido pelo fabricante do acoplamento.

Recomenda-se manter uma margem de segurança nestes valores.

Em alinhamento/nivelamento, é importante levar em consideração o efeito da temperatura do alternador e da máquina acionante. Diferentes níveis de dilatação das máquinas acopladas podem mudar o alinhamento/nivelamento durante a operação.

4.9.2.2 Alternadores com mancal único (B15T):

A base deve ser plana, permitindo um correto apoio do alternador sobre a mesma. Sempre que possível, deve-se utilizar isoladores de vibração (amortecedores) entre o conjunto alternador + motor e base a fim de minimizar a transmissão de vibração. Quando não for possível o uso dos isoladores entre conjunto e base, é preciso utilizar o isolador entre base e solo. Uma das duas configurações é recomendada, sob pena de haver operação com altos níveis de vibração.



4.9.3 Acoplamento

4.9.3.1 Alternadores com duplo mancal (B35T/B3T)

4.9.3.1.1 Acoplamento direto

Deve-se preferir sempre o acoplamento direto, devido ao menor custo, reduzido espaço ocupado, ausência de deslizamento (correias) e maior segurança contra acidentes. No caso de transmissão com relação de velocidade, é usual também o acoplamento direto através de redutores.



ATENÇÃO

Alinhar cuidadosamente as pontas de eixos, usando acoplamento flexível, sempre que possível, deixando folga mínima de 3mm entre os acoplamentos.

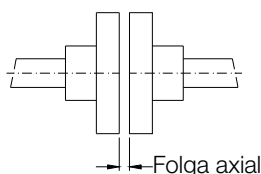


Figura 4.7 - Folga axial

4.9.3.1.2 Acoplamento por polias e correias

Quando uma relação de velocidade é necessária, a transmissão por correia é a mais frequentemente usada. Evitar esforços radiais desnecessários nos mancais, situando os eixos paralelos entre si e as polias perfeitamente alinhadas.

Correias que trabalham lateralmente enviesadas transmitem batidas de sentido alternante ao rotor, e poderão danificar os encostos do mancal. O escorregamento da correia poderá ser evitado com aplicação de um material resinoso, como o breu, por exemplo.

A tensão na correia deverá ser apenas suficiente para evitar o escorregamento no funcionamento.



NOTA

Correia com excesso de tensão aumenta o esforço na ponta de eixo, causando vibração e fadiga, podendo chegar até a fratura do eixo.

Deve ser evitado o uso de polias demasiadamente pequenas; estas provocam flexões no eixo do alternador devido ao fato que a tração na correia aumenta a medida que diminui o diâmetro da polia.



ATENÇÃO

Os alternadores com mancal duplo são fabricados para aplicações com acoplamento direto.

Em aplicações com uso de polias e correias, a WEG deverá ser consultada para garantir uma aplicação correta do alternador.



NOTA

Sempre utilizar polias devidamente balanceadas. Evitar sobras de chavetas, pois estas representam um aumento da massa de desbalanceamento. Caso estas observações não forem seguidas, ocorrerá aumento nos níveis de vibração.

4.9.3.2 Alternador com mancal único (B15T)

4.9.3.2.1 Medida "G"

Os alternadores saem da fábrica montados com os discos e flanges de acordo com a solicitação do cliente. A medida G é a distância entre a face externa dos discos em relação à face do flange, conforme Figura 4.8:



NOTA

Os alternadores saem de fábrica com a medida "G" conforme Tabela 4.10. Cabe ao montador do grupo gerador a responsabilidade de verificar se a medida "G" está de acordo com o motor diesel utilizado. Caso a medida "G" não seja respeitada, poderão ocorrer sérios danos ao alternador e ao motor diesel ou, em alguns casos, não será possível acoplar o alternador ao motor diesel.

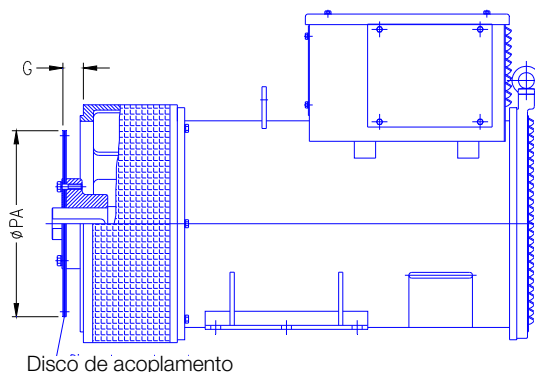


Figura 4.8 - Medida G

Tabela 4.10: Medidas "G" padrões

ØPA (mm)	Disco de Acoplamento (SAE)	G (mm)
241,3	7,5	30,2
263,4	8	61,9
314,2	10	53,9
352,3	11,5	39,6
466,6	14	25,4
517,5	16	15,7
571,4	18	15,7
673,1	21	0,0
733,4	24	0,0
▪ A medida ØPA possui uma tolerância de -0,13mm		



4.9.3.2.2 Alteração da medida G

Caso seja necessário alterar a medida "G", a posição dos discos de acoplamento (E) deve ser alterada.

Para isso basta retirar ou adicionar os **anéis espaçadores (I)**, conforme indicado na Figura 4.9.

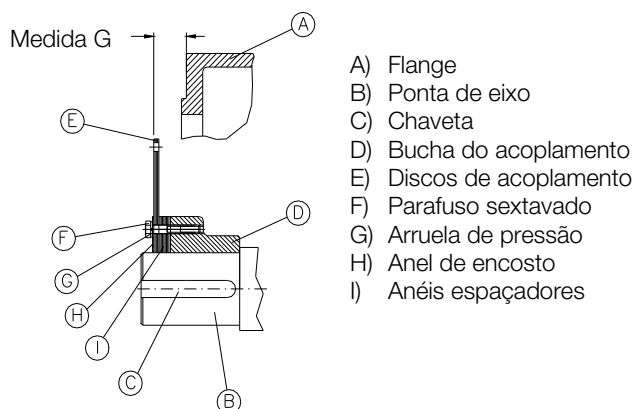


Figura 4.9 - Procedimento para alteração da medida G



NOTA

Para atender a combinação de flange e disco necessário, também poderá ser trocado o flange (A).

A fixação do disco de acoplamento deve ser feita conforme os torques de aperto mostrados na Tabela 4.11

Tabela 4.11 - Torque de aperto dos discos de acoplamento

CARCAÇA	PARAFUSO DE FIXAÇÃO (CLASSE 10.9)	TORQUE DE APERTO
160	6xM12x1,75	119 a 126
200	6xM12x1,75	119 a 126
250	10xM10x1,25	68 a 72
315	12xM12x1,5	119 a 126
355	12xM20x2,50	566 a 595
400	12xM20x2,50	566 a 595

- Para carcaças maiores, consultar a WEG
- Fixar os parafusos com cola química de alto torque



NOTA

O usuário é responsável pela instalação do alternador.

A WEG não se responsabiliza por danos no alternador, equipamentos associados e instalação, ocorridos devido a:

- Vibrações excessivas transmitidas;
- Instalações precárias;
- Falhas de alinhamento;
- Condições de armazenamento inadequadas;
- Não observação das instruções antes da partida;
- Conexões elétricas incorretas.



5 ENTRADA EM SERVIÇO

- O alternador sai da fábrica com trava no eixo ou disco para melhor segurança no transporte. Antes de colocá-lo em funcionamento, esta trava deve ser retirada.
- A conexão dos terminais respeita as características nominais de placa do alternador.
- Para realizar o ajuste de tensão e frequência, consultar o manual do regulador de tensão.

5.1 EXAME PRELIMINAR

Antes de ser dada a partida inicial ou após um longo tempo sem operação, verifique:

1. Se o alternador está limpo e se foram removidos os materiais de embalagem e os elementos de proteção;
2. Se as partes de conexão do acoplamento estão em perfeitas condições e devidamente apertadas e engraxadas onde necessário;
3. Se o alternador está alinhado;
4. Se os rolamentos estão devidamente lubrificados e em condições de uso;
5. Se os cabos dos protetores térmicos, aterramento e das resistências de aquecimento estão conectados. (quando existirem);
6. Se a resistência de isolamento dos enrolamentos tem o valor prescrito;
7. Se todos os objetos, tais como ferramentas, instrumentos de medição e dispositivos de alinhamento foram removidos da área de trabalho do alternador;
8. Se o alternador está corretamente fixado;
9. Se as conexões elétricas estão de acordo com o esquema de ligação do alternador;
10. Se o regulador de tensão está corretamente conectado e ajustado, de acordo com seu manual de instalação;
11. Se os condutores da rede estão devidamente ligados aos bornes principais, de modo a impossibilitar um curto-circuito ou soltarem-se;
12. Se o alternador está devidamente aterrado;
13. Girar manualmente o conjunto a fim de verificar se não existe interferência no entreferro. Acionado o alternador a vazio, ele deve girar levemente e sem ruídos estranhos;
14. Se as entradas e saídas de ar encontram-se desobstruídas;
15. Se a medida "G" está de acordo com a especificação para o motor diesel a ser acoplado (para alternadores de mancal único).



ATENÇÃO

A função U/F do regulador é ajustada na fábrica, porém como segurança adicional é recomendável desconectar o regulador.

- d) Girar o conjunto e verificar se não apresenta ruídos estranhos;
 - e) Acionar o alternador até a rotação nominal e verificar ruído, vibração e checar todos os dispositivos de proteção;
- Após seguir os procedimentos descritos anteriormente e solucionado eventuais problemas ocorridos (ver anomalias / soluções), desligar o conjunto.
- f) Com o alternador completamente parado, conectar o regulador de tensão (repor o fusível), acionar o conjunto e efetuar os ajustes necessários. O manual do regulador de tensão descreve os procedimentos para os ajustes disponíveis (estabilidade, tensão, U/F).
 - g) Fechar o disjuntor do circuito principal e aplicar carga e monitorar a corrente do alternador certificando-se de que está dentro do especificado.
 - h) Verificar os níveis de vibração e temperatura do conjunto e monitorar os instrumentos de medição (corrente, tensão e frequência). Caso houver variação significativa na vibração do conjunto entre a condição inicial e após a estabilidade térmica, é necessário reavaliar o alinhamento/ nivelamento do conjunto.



ATENÇÃO

Todos os instrumentos de medição e controle deverão ficar sob observação constante a fim de que eventuais alterações na operação possam ser detectadas e sanadas.

5.2 OPERAÇÃO INICIAL

Além de seguir as instruções de segurança citadas no capítulo 2.2 deste manual, para colocar o alternador em operação pela primeira vez, o seguinte procedimento deverá ser adotado:

- a) Certificar-se de que os terminais do alternador estão desconectados da carga através da remoção de fusíveis no painel ou colocação da chave ou disjuntor na posição "desligar";
- b) Desligar as resistências de aquecimento do alternador (se houverem), antes de colocá-lo em funcionamento;
- c) Desconectar o regulador de tensão (removendo o fusível em série com a bobina auxiliar);

- Antes de parar o alternador, abrir o disjuntor do circuito principal para desconectar a carga;
- Se o alternador está equipado com resistência de aquecimento, certificar-se que estas permaneçam energizadas enquanto o alternador permanecer parado.



Mesmo após a desexcitação, ainda existe tensão nos bornes da máquina, por isso somente após a parada total do equipamento é permitido realizar qualquer trabalho. Constitui risco de morte não atentar para o descrito acima.

No caso de aparecerem correntes elevadas de neutro, utilizar uma bobina de aterramento ou abrir a ligação de neutro de um dos alternadores. Isto acontece principalmente quando os alternadores não são iguais ou quando alimentam cargas com elevado conteúdo de harmônicos.



Este tipo de instalação deve ser realizada por equipe técnica especializada. Para operações transitórias em paralelo (ex. rampa de carga) em que o alternador irá operar de modo singelo após o período em paralelo, o TC de paralelismo deve ser curto-circuitado, pois este é desnecessário nesta operação.



6 MANUTENÇÃO

Os procedimentos de manutenção deverão ser seguidos para assegurar o bom desempenho do equipamento. A frequência das inspeções dependerá essencialmente das condições locais de aplicação e do regime de trabalho. A não observância de um dos itens relacionados a seguir pode significar em redução da vida útil do alternador, paradas desnecessárias e/ou danos nas instalações.

6.1 GRUPOS GERADORES DE EMERGÊNCIA

Os alternadores utilizados em grupos geradores de emergência devem, conforme grau de umidade do local de instalação, receber carga de 2 a 3 horas a cada mês.

6.2 LIMPEZA

A carcaça, venezianas, grades e defletoras devem ser mantidas limpas, sem acúmulo de óleo ou poeira na sua parte externa, para facilitar a troca de calor com o ambiente.

Também em seu interior, os alternadores devem ser mantidos limpos, isentos de poeira, detritos e óleo. Para limpá-los, deve-se utilizar escovas ou panos de algodão limpos. Se a poeira não for abrasiva, deve-se empregar um jateamento de ar comprimido, soprando a sujeira da tampa defletora e eliminando todo acúmulo de pó contido nas pás do ventilador e carcaça.

Os detritos impregnados de óleo ou umidade podem ser limpos com panos umedecidos em solventes adequados. A caixa de ligação deve apresentar os bornes limpos, sem oxidação, em perfeitas condições mecânicas e sem depósitos de graxa ou zinabre.

6.3 RUÍDO

O ruído deverá ser observado em intervalos regulares de 1 a 4 meses. No caso de anomalia o alternador deve ser parado e as causas devem ser investigadas e sanadas.

6.4 VIBRAÇÃO

Nível de vibração máximo para o alternador em carga: **20mm/s** (RMS).

6.5 ROLAMENTOS

O controle da temperatura no mancal também faz parte da manutenção de rotina dos alternadores. A elevação de temperatura não deverá ultrapassar os 60°C, medida no anel externo do rolamento.

A temperatura poderá ser controlada permanentemente com termômetros, colocados do lado de fora do mancal, ou com termo-elementos embutidos (opcionais).

As temperaturas de alarme e desligamento para os mancais podem ser ajustadas respectivamente para 110°C e 120°C.

6.5.1 Lubrificação

Os alternadores com tamanho de carcaça até 315 possuem rolamentos blindados, não sendo necessário fazer a relubrificação dos mesmos. Estes devem ser substituídos quando atingirem 20.000 horas de trabalho ou 30 meses, prevalecendo o que ocorrer primeiro. Para os alternadores da carcaça 355 e maiores, os rolamentos devem ser relubrificadas **anualmente** ou

conforme os intervalos de lubrificação informados na tabela a seguir, prevalecendo o que ocorrer primeiro:

Tabela 6.1 - Dados dos rolamentos

Carcaça	Mancal	Rolamento	Intervalo de lubrificação (horas de operação)	Qtde. graxa (g)
160	LA	6211 2RS	-	-
	LOA	6209 2RS	-	-
200	LA	6313 2RS	-	-
	LOA	6210 2RS	-	-
250	LA	6318 2RS-C3	-	-
	LOA	6214 2RS	-	-
315	LA	6320 2RS-C3	-	-
	LOA	6316 2RS-C3	-	-
355	LA	6322-C3	4.500	60
	LOA	6220-C3	4.500	31
400	LA	6324-C3	4.500	72
	LOA	6226-C3	4.500	46

1) A vida útil estimada para os rolamentos relubrificáveis é de **40.000 horas**

- Para as demais carcaças, consultar a WEG.
- LA = Lado Acionado
- LOA = Lado Não Acionado

6.5.1.1 Tipo e quantidade de graxa

A relubrificação dos mancais deve ser feita sempre com a **graxa original**, especificada na placa de características dos mancais e na documentação do alternador. Os alternadores WEG da Linha G são fornecidos com graxa POLIREX EM 103.



ATENÇÃO

1. A WEG não recomenda a utilização de graxa diferente da graxa original do alternador.
2. Quando o mancal for aberto, injetar a graxa nova através da graxeira para expelir a graxa velha que se encontra no tubo de entrada da graxa e aplicar a graxa nova no rolamento, no anel interno e anel externo, preenchendo 3/4 dos espaços vazios.
3. Nunca limpar o rolamento com panos a base de algodão, pois podem soltar fiapos, servindo de partícula sólida.
4. É importante fazer uma lubrificação correta, isto é, aplicar a graxa correta e em quantidade adequada, pois tanto uma lubrificação deficiente quanto uma lubrificação excessiva trazem efeitos prejudiciais ao rolamento.
5. Uma lubrificação em excesso acarreta elevação de temperatura, devido à grande resistência que oferece ao movimento das partes rotativas e, principalmente, devido ao batimento da graxa, que acaba por perder completamente suas características de lubrificação.



**NOTA**

A WEG não se responsabiliza pela troca da graxa ou mesmo por eventuais danos oriundos da troca.

6.5.1.2 Instruções para lubrificação

O sistema de lubrificação foi projetado de tal modo que durante a relubrificação dos rolamentos, toda a graxa velha seja removida das pistas dos rolamentos e expelida através de um dreno que permite a saída da mesma, mas impede a entrada de poeira ou outros contaminantes nocivos para dentro do rolamento.

Este dreno também evita a danificação dos rolamentos pelo conhecido problema de relubrificação excessiva. É aconselhável fazer a relubrificação com o alternador em operação, para assim assegurar a renovação da graxa no alojamento do rolamento.

Se isso não for possível devido à presença de peças girantes perto da engraxadeira (polias etc.), que podem por em risco a integridade física do operador, proceda da seguinte maneira:

- Com o alternador parado, injetar aproximadamente a metade da quantidade total da graxa prevista e operar o alternador durante aproximadamente 1 minuto em plena rotação;
- Parar o alternador e injetar o restante da graxa. A injeção de toda a graxa com o alternador parado pode causar a penetração de parte do lubrificante para o interior do alternador.

**ATENÇÃO**

É importante limpar as graxadeiras antes da lubrificação, para evitar que materiais estranhos sejam arrastados para dentro do rolamento.

**NOTA**

Os dados dos rolamentos, quantidade e tipo de graxa e intervalos de lubrificação são informados em uma placa de identificação fixada no alternador. Verifique estas informações antes de fazer a lubrificação.

- Os intervalos de lubrificação informados na placa consideram uma temperatura de trabalho do rolamento de 70°C.
- Baseado nas faixas de temperatura de operação relacionadas abaixo, aplique os seguintes fatores de correção para os intervalos de lubrificação dos rolamentos:
 - Temperatura de operação menor que 60°C: 1,59.
 - Temperatura de operação de 70°C a 80°C: 0,63.
 - Temperatura de operação de 80°C a 90°C: 0,40.
 - Temperatura de operação de 90°C a 100°C: 0,25.
 - Temperatura de operação de 100°C a 110°C: 0,16.

6.5.1.3 Procedimentos para a relubrificação dos rolamentos

1. Retirar a tampa do dreno;
2. Limpar com pano de algodão ao redor do orifício da graxeira;

3. Com o alternador em operação, injetar a graxa até que a graxa nova comece a sair pelo dreno ou até ter sido introduzida a quantidade de graxa informada na Tabela 6.1;
4. Operar o alternador durante o tempo suficiente para que o excesso de graxa se escoe pelo dreno;
5. Inspeção a temperatura do mancal para certificar-se de que não houve nenhuma alteração significativa;
6. Recolocar novamente a tampa do dreno.

6.5.2 Troca de Rolamentos**ATENÇÃO**

Por questões de segurança, a troca de rolamentos deve ser efetuada com o alternador desacoplado da máquina acionante.

6.5.2.1 Alternador com mancal único – B15T**Carcaça 160 e 200**

1. Colocar o alternador na posição vertical com o lado dos discos de acoplamento para cima;
2. Retirar o rotor completo, de preferência utilizando um olhal que possua a mesma rosca do furo do centro da ponta de eixo, elevando-o com a utilização de uma talha;
3. Substituir o rolamento e recolocar o rotor completo, certificando-se que o anel o'ring esteja na posição correta no cubo da tampa traseira.

Carcaça 250

1. Soltar os cabos da excitatriz (F+) e (F-).
2. Retirar a tampa e a veneziana traseira para ter acesso ao rolamento e efetuar a troca.

Carcaças 315 a 400

Para desmontar a parte traseira do alternador e ter acesso ao rolamento, seguir as instruções abaixo:

1. Soltar os cabos (F+) e (F-) na caixa de ligação;
2. Retirar a veneziana traseira;
3. Soltar os cabos do rotor principal conectados na ponte retificadora do rotor da excitatriz;
4. Retirar os parafusos que fixam o rotor da excitatriz no eixo e retirá-lo manualmente;
5. Retirar os parafusos da tampa traseira fixada na carcaça e retirar esta tampa juntamente com o estator da excitatriz;
6. Substituir o rolamento e montar o alternador.

6.5.2.2 Alternador com mancal duplo – B35T

Para efetuar a troca dos rolamentos no alternador com mancal duplo, é necessário desmontar o alternador por completo.

6.5.2.3 Substituição do rolamento

A desmontagem dos rolamentos deve ser feita sempre com a utilização de ferramentas adequadas (extrator de rolamentos).

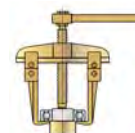


Figura 6.1 – Dispositivo para sacar rolamento





ATENÇÃO

Um rolamento somente deve ser removido do eixo quando for absolutamente necessário

Instruções:

1. As garras do extrator deverão ser aplicadas sobre a face lateral do anel interno do rolamento a ser desmontado ou sobre uma peça adjacente.
2. Antes da montagem dos rolamentos novos, os assentos do eixo devem ser limpos e levemente lubrificados.
3. Os rolamentos devem ser aquecidos à uma temperatura entre 50°C e 100°C para facilitar a montagem.
4. Os rolamentos não devem ser submetidos a pancadas, quedas, armazenagem com vibração ou umidade, pois podem provocar marcas nas pistas internas ou nas esferas, reduzindo sua vida útil.

6.6 MANUTENÇÃO DA EXCITATRIZ

6.6.1 Excitatriz

Para o bom desempenho de seus componentes, a excitatriz do alternador deve ser mantida limpa. Verificar a resistência de isolamento dos enrolamentos da excitatriz principal e da excitatriz auxiliar (se houver) periodicamente para determinar as condições de isolamento dos mesmos, seguindo os procedimentos descritos neste manual.

6.6.2 Teste nos diodos

Os diodos são componentes que possuem grande durabilidade e não exigem testes frequentes. Caso o alternador apresente algum defeito que indique falha nos diodos ou um aumento da corrente de campo para uma mesma condição de carga, então os diodos devem ser testados conforme procedimento a seguir:

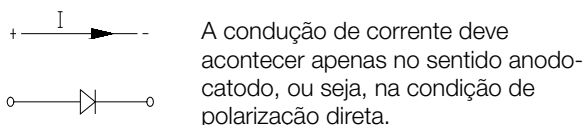
1. Soltar as ligações de todos os diodos com o enrolamento do rotor da excitatriz;
2. Com um ohmímetro, medir a resistência de cada diodo em ambas as direções.



NOTA

Quando testar os diodos, observar a polaridade dos terminais de teste em relação à polaridade do diodo.

A polaridade do diodo é indicada por uma seta em sua carcaça.



O diodo é considerado bom quando apresentar baixa resistência ôhmica (até aproximadamente 100Ω) na sua direção direta e alta resistência (aprox. 1MΩ) na direção contrária. Diodos defeituosos terão resistência ôhmica de 0Ω ou maior que 1MΩ em ambas as direções medidas.

Na maioria dos casos, o método com ohmímetro para testar os diodos é suficiente para identificar falhas nos diodos. No entanto, em alguns casos extremos poderá ser necessária a aplicação da tensão nominal de bloqueio e/ou circulação de corrente para detectar falha nos diodos. Devido aos esforços requeridos para estes testes, em caso de dúvida, recomenda-se realizar a troca dos diodos.

6.6.3 Substituição dos diodos

Para ter acesso aos diodos e poder realizar a troca, é necessário:

- Desmontar o alternador (carcaça 160);
- Retirar a tampa de inspeção traseira (carcaça 200);
- Retirar a veneziana traseira (carcaças 250 a 400).
- Para as demais carcaças, consultar a WEG.

Para fazer a substituição dos diodos, proceder da seguinte maneira;

- Desfazer a ligação dos 6 diodos com o rotor da excitatriz;
- Soltar o suporte de diodos do rotor da excitatriz e retirá-lo;
- Fixar o suporte em um torno de bancada com proteção no mordente, e retirar todos os diodos;
- Instalar três diodos novos de mesma polaridade (AND ou CTD) em uma das pontes de ligação;
- Instalar na outra ponte de ligação, três novos diodos de polaridade contrária a dos três diodos instalados anteriormente;
- Fixar todos os diodos, apertando-os com torquímetro respeitando os torques aperto da Tabela 6.2;
- Fixar o conjunto de diodos no rotor da excitatriz;
- Fazer as conexões dos diodos com o enrolamento do rotor da excitatriz.



ATENÇÃO

É de fundamental importância que os torques de aperto indicados sejam respeitados a fim de que os diodos não sejam danificados na montagem.

Tabela 6.2 - Torque de aperto dos diodos

Rosca da base do diodo (mm)	Chave do torquímetro (mm)	Torque de aperto (Nm)
M6	11	2
M8	17	4
M12	24	10
M16	32	30

Tabela 6.3 - Tabela de diodos utilizados

Carcaça	Designação WEG		Designações comerciais
			Semikron
160	DS4	AND	SKN26/12
		CTD	SKR26/12
200 - 315	DS6	AND	SKN50/12
		CTD	SKR50/12
355 - 450	DS8	AND	SKN71/12
		CTD	SKR71/12

▪ Para demais carcaças consultar a WEG



6.6.4 Teste no varistor

O varistor é o dispositivo instalado entre as duas pontes de ligação dos diodos e têm a finalidade de proteger os diodos contra sobretensão.

Para testar as condições de funcionamento do varistor pode ser utilizado um ohmímetro.

A resistência de um varistor deve ser muito alta (± 20.000 ohms).

No caso de danos verificados no varistor ou se sua resistência for muito baixa, este deve ser substituído.

6.6.5 Substituição do varistor

Para substituir o varistor, a WEG recomenda que sejam seguidas as seguintes recomendações:

1. Substituir o varistor danificado por um novo idêntico ao original, conforme informado na Tabela 4.8;
2. Para substituir o varistor, soltar os parafusos que o fixam às pontes de ligação dos diodos;
3. Ao remover o varistor, observar atentamente como os componentes foram montados para que novo varistor seja instalado da mesma forma;
4. Antes de montar o novo varistor, certificar-se que todas as superfícies de contato dos componentes estejam limpas, niveladas e lisas para assim assegurar um perfeito contato entre elas;
5. Fixar o novo varistor apertando os parafusos que o prendem às pontes de ligação somente o suficiente para fazer uma boa conexão elétrica, observar o preenchimento com silicone no compartimento do novo capacitor.

6.6.6 Teste no capacitor

O capacitor é o dispositivo instalado entre as duas pontes de ligação dos diodos e têm a finalidade de proteger os diodos contra surtos de tensão.

Para testar as condições de funcionamento do capacitor pode ser utilizado um multímetro com a função de medição de capacitância.

A capacitância medida deve ser conforme a especificação do componente;

No caso de danos verificados no capacitor ou se sua capacitância for acima da tolerância especificada, este deve ser substituído.

6.6.7 Substituição do capacitor

Para substituir o capacitor, a WEG recomenda que sejam seguidas as seguintes recomendações:

1. Substituir o capacitor danificado por um novo idêntico ao original, conforme informado na Tabela 4.8;
2. Para substituir o capacitor, solte os parafusos que o fixam às pontes de ligação dos diodos.
3. Ao remover o capacitor, observe atentamente como os componentes foram montados para que novo capacitor seja instalado da mesma forma.
4. Antes de montar o novo capacitor, certifique-se que os terminais e parafusos de conexão estejam limpos, assegurando um perfeito contato entre elas.
5. Fixar o novo capacitor apertando os terminais que o prendem às pontes de ligação, somente o suficiente para fazer uma boa conexão elétrica. Observar o preenchimento com silicone no compartimento do novo capacitor.

6.7 FLUXO DE AR

As entradas e saídas de ar do alternador devem ser mantidas desobstruídas a fim de que a troca de calor seja eficiente. Caso haja deficiência na troca de calor, o alternador irá sobreaquecer podendo danificar a bobinagem (queima do alternador).

6.8 REVISÃO COMPLETA

A periodicidade das revisões deve ser definida em função do ambiente onde o alternador estiver instalado. Quanto mais agressivo for o ambiente (sujeira, óleo, maresia, poeira, etc.) menor deverá ser o intervalo de tempo entre as revisões, conforme segue:

- Limpar os enrolamentos sujos com pincel ou escova;
- Usar um pano umedecido em solventes adequados para remover graxa, óleo e outras sujeiras do enrolamento;
- Secar com ar seco;
- Passar ar comprimido através dos canais de ventilação no pacote de chapas do estator, rotor e mancais.



NOTA

O ar comprimido sempre deve ser passado após a limpeza, nunca antes.

- Drenar a água condensada;
- Limpar o interior das caixas de ligação;
- Medir a resistência de isolamento.

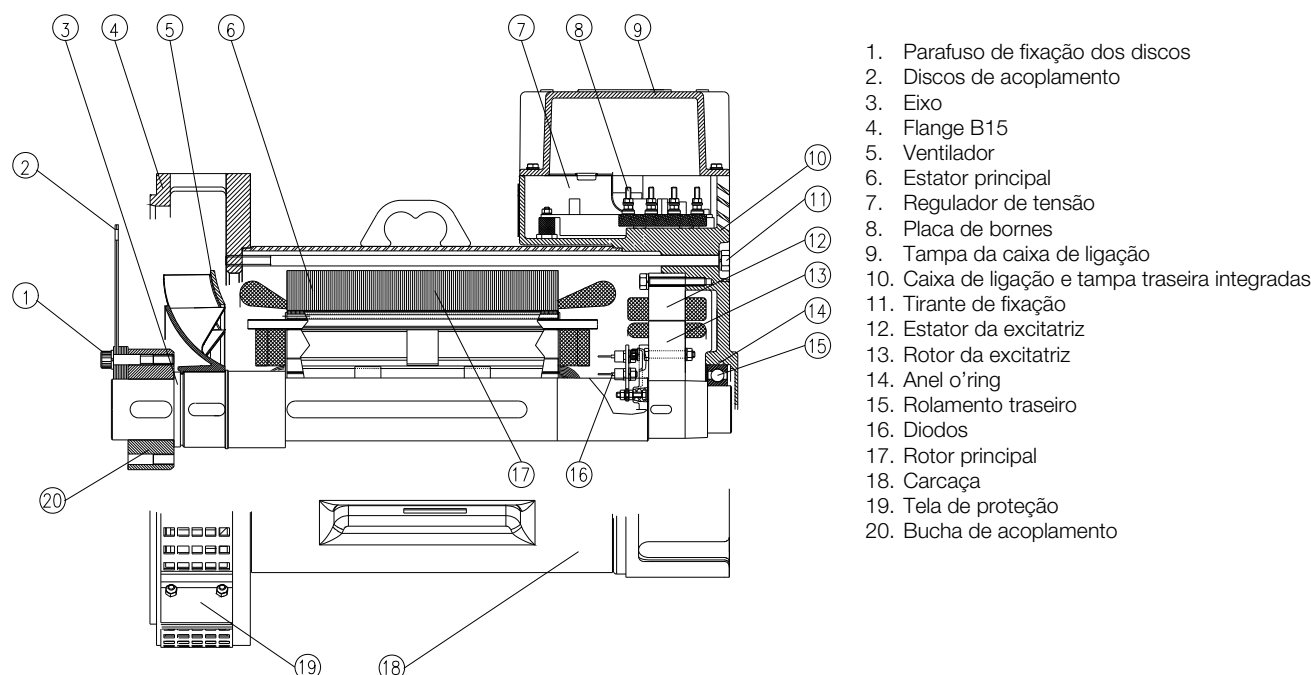


ATENÇÃO

A ausência de revisões completas nos alternadores irá provocar acúmulo de sujeira no seu interior. O funcionamento nestas condições poderá reduzir a vida útil da máquina e provocar paradas indesejáveis e custos adicionais para a recuperação do equipamento.



6.9 DESMONTAGEM, MONTAGEM E LISTA DE PEÇAS – GTA160



Desmontagem

1. Para desmontagem do alternador, coloque o mesmo na posição vertical com o lado dos discos de acoplamento para cima;
2. Retirar os discos de acoplamento;
3. Retirar o rotor completo, utilizando um olhal que possua a mesma rosca do furo do centro da ponta de eixo, elevando-o com a utilização de uma talha;
4. Marcar a posição do flange (4) e da tampa traseira (10) em relação à carcaça (18). Assim será garantido o alinhamento original e ideal entre as três peças;
5. Colocar o alternador na posição horizontal sobre uma base, de tal maneira que os pés e o flange fiquem aéreos, soltar os cabos de ligação principais da placa de bornes e os cabos do regulador de tensão (7);
6. Retirar os tirantes (11) que fixam a tampa traseira e o flange dianteiro à carcaça. **Ao retirar os tirantes, a tampa traseira e o flange ficarão soltos e poderão cair;**
7. Utilizando um martelo de borracha, retirar a tampa traseira, certificando-se que os cabos da caixa de ligação estejam todos liberados evitando assim que os mesmos sejam danificados. Da mesma forma, retirar o flange dianteiro.



NOTA

Para desmontagem dos alternadores com mancal duplo (forma construtiva B35T) primeiramente deve-se retirar o flange e a tampa dianteira.

Montagem

1. Verificar se as partes usinadas de encaixe da carcaça e do flange e tampa traseira estão limpas e com proteção anti-corrosiva;
2. Com a carcaça colocada horizontalmente sobre uma base plana, alinhar a marcação da tampa traseira e do flange dianteiro com a marcação da carcaça e encaixe-as, tomando os devidos cuidados com os cabos do estator principal e do estator da excitatriz para não danificá-los;
3. Fixar o flange e a tampa traseira com os tirantes de fixação (11) correspondentes;
4. Colocar o alternador na posição vertical com o lado do flange para cima;
5. Inserir o rotor completo no interior da carcaça, tomando os devidos cuidados para não danificar as bobinas do rotor da excitatriz e do rotor principal;
6. Colocar o alternador na posição horizontal;
7. Certificar-se de que o rolamento esteja encaixado no assento e que o anel o'ring (14) esteja na posição correta;
8. Fazer as ligações dos cabos do regulador de tensão e da excitatriz, conforme esquema elétrico do alternador e manual do regulador de tensão.
9. Certificar-se de que todas as ligações dos cabos principais, regulador de tensão e excitatriz estejam corretos.

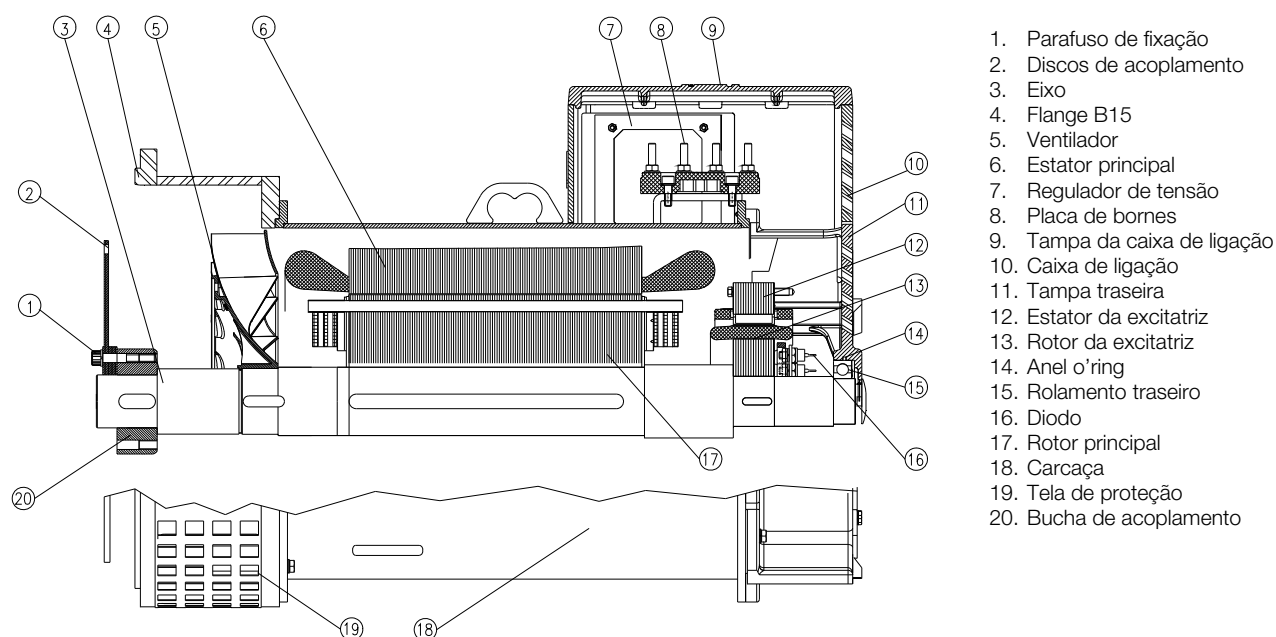


NOTA

- Durante a montagem, os tirantes de fixação devem ser perfeitamente alinhados para obter um correto alinhamento das partes fixadas.
- Para montagem dos alternadores com mancal duplo (forma construtiva B35T) deve-se montar ainda a tampa e o flange dianteiros.



6.10 DESMONTAGEM, MONTAGEM E LISTA DE PEÇAS - GTA200



Desmontagem

1. Para desmontagem do alternador, deve-se colocar o mesmo na posição vertical com o lado dos discos de acoplamento para cima;
2. Retirar os discos de acoplamento (2);
3. Retirar o rotor completo, utilizando um olhal que possua a mesma rosca do furo do centro da ponta de eixo, elevando-o com a utilização de uma talha;
4. Marcar a posição da tampa traseira (11) em relação à carcaça (18). Assim será garantido o alinhamento original e ideal entre estas peças;
5. Colocar o alternador na posição horizontal sobre uma base, de tal maneira que os pés e o flange fiquem aéreos;
6. Retirar a tampa da caixa de ligação (9), soltar os cabos de ligação principais da placa de bornes (8), os cabos do regulador de tensão (7) e da excitatriz (12);
7. Soltar os parafusos que fixam a caixa de ligação (10) na tampa traseira (11) e retire-a;
8. Retirar os parafusos que fixam a tampa traseira à carcaça;
9. Utilizando um martelo de borracha, retirar a tampa traseira certificando-se que os cabos de ligação estejam todos liberados evitando assim que os mesmos sejam danificados;
10. Da mesma forma, se for necessário, retirar o flange dianteiro (4).



NOTA

Para desmontagem dos alternadores com mancal duplo (forma construtiva B35T) primeiramente deve-se retirar o flange e a tampa dianteira.

Montagem

1. Verificar se as partes usinadas de encaixe da carcaça, do flange e tampa traseira estão limpas e com proteção anti-corrosiva;
2. Com a carcaça colocada horizontalmente sobre uma base plana, alinhar a marcação da tampa traseira com a marcação da carcaça e encaixá-las, tomando os devidos cuidados com os cabos do estator principal e do estator da excitatriz para não danificá-los;
3. Fixar a tampa traseira com os parafusos de fixação correspondentes;
4. Fixar a caixa de ligação na tampa traseira;
5. Colocar o alternador na posição vertical com o lado do flange para cima;
6. Inserir o rotor completo no interior da carcaça, tomando os devidos cuidados para não danificar as bobinas do rotor da excitatriz e do rotor principal;
7. Colocar o alternador na posição horizontal;
8. Certificar-se de que o rolamento esteja encaixado no assento e que o anel o'ring (14) esteja na posição correta;
9. Fazer as ligações dos cabos do regulador de tensão e da excitatriz, conforme esquema elétrico do alternador e manual do regulador de tensão;
10. Certificar-se de que todas as ligações dos cabos principais, regulador de tensão e excitatriz estejam corretas.

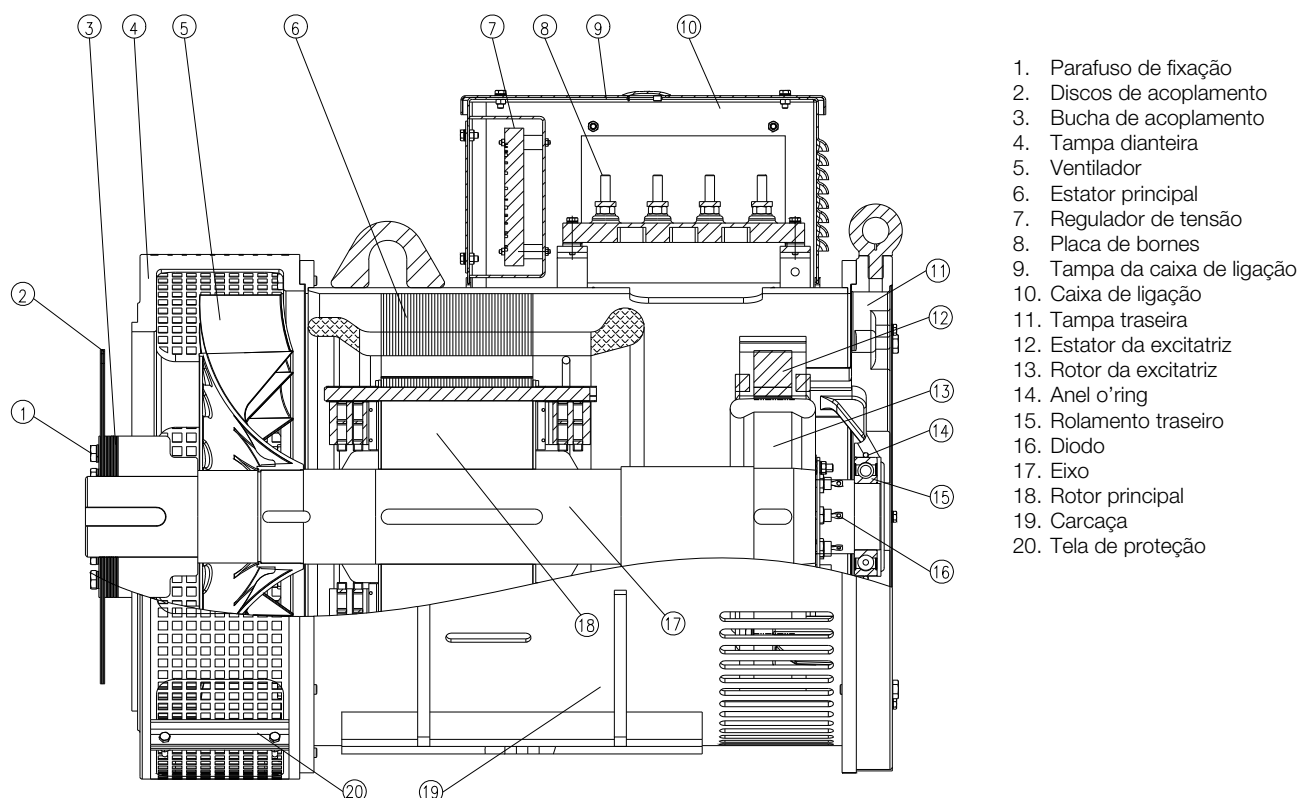


NOTA

Para montagem dos alternadores com mancal duplo (forma construtiva B35T) deve-se montar ainda a tampa e o flange dianteiros.



6.11 DESMONTAGEM, MONTAGEM E LISTA DE PEÇAS - GTA250



Desmontagem

1. Abrir a tampa da caixa de ligação (9) e desconectar os cabos do regulador de tensão e da excitatriz;
2. Soltar os parafusos que fixam a caixa de ligação (10) na carcaça (19) e retirá-la;
3. Retire a tela de proteção (20);
4. Soltar os parafusos que fixam o flange dianteiro (4) na carcaça e retirá-lo;
5. Retirar as abraçadeiras e espiral para liberar os cabos do estator principal e da excitatriz;
6. Soltar os parafusos que fixam a tampa traseira (11) na carcaça e retirá-la, utilizando um martelo de borracha;
7. A retirada do rotor completo deve ser feita pelo lado dianteiro do alternador, utilizando dispositivo apropriado.



NOTA

Para desmontagem dos alternadores com mancal duplo (forma construtiva B35T) primeiramente retire o flange e a tampa dianteira.

Montagem

1. Verificar se as partes usinadas de encaixe da carcaça e do flange e tampa traseira estão limpas e com proteção anti-corrosiva;
2. Inserir o rotor principal pelo lado dianteiro com dispositivo apropriado;
3. Verificar se o anel o'ring (14) está corretamente colocado no assento do rolamento da tampa traseira;
4. Encaixar a tampa traseira (11) no rolamento e fixá-la;
5. Colocar a caixa de ligação na posição correta e fixá-la com os parafusos apropriados;
6. Fazer as ligações dos cabos do regulador de tensão e da excitatriz, conforme esquema elétrico do alternador e manual do regulador de tensão.

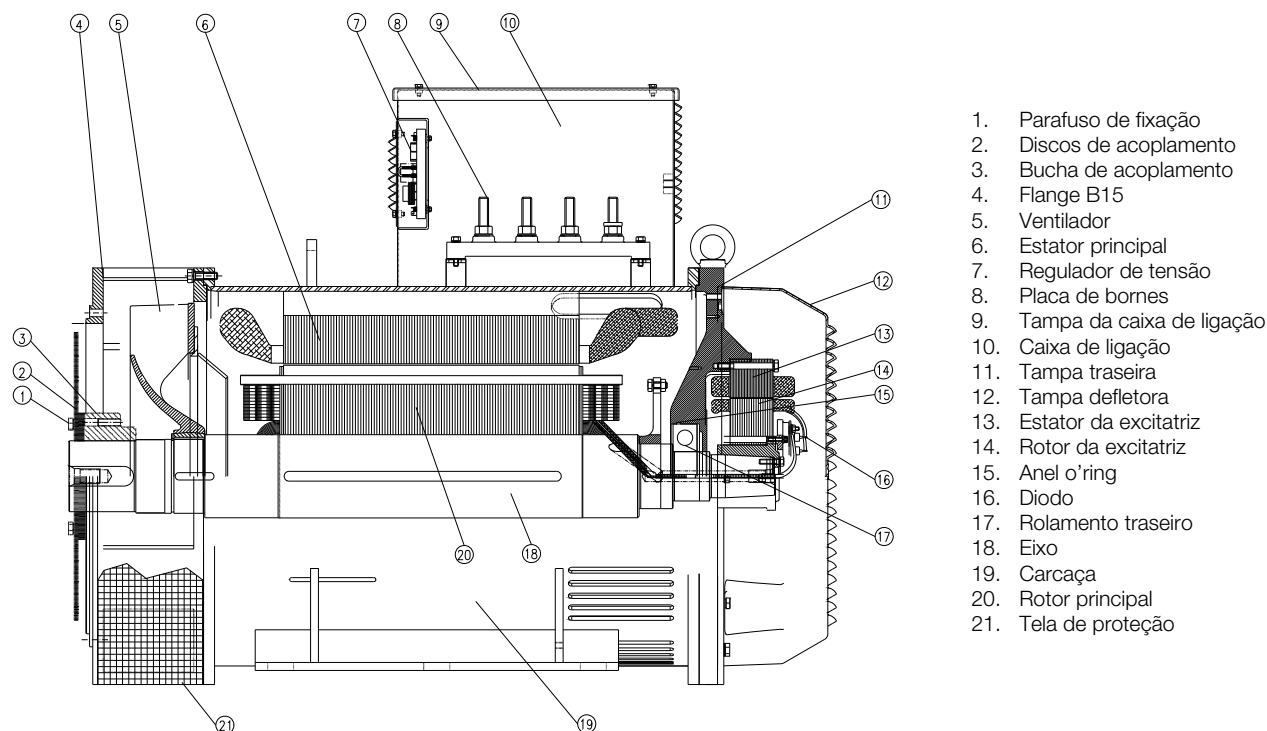


NOTA

Para montagem dos alternadores com mancal duplo (forma construtiva B35T) deve-se montar ainda a tampa e o flange dianteiros.



6.12 DESMONTAGEM, MONTAGEM E LISTA DE PEÇAS - GTA315 a GTA400



1. Parafuso de fixação
2. Discos de acoplamento
3. Bucha de acoplamento
4. Flange B15
5. Ventilador
6. Estator principal
7. Regulador de tensão
8. Placa de bornes
9. Tampa da caixa de ligação
10. Caixa de ligação
11. Tampa traseira
12. Tampa defletora
13. Estator da excitatriz
14. Rotor da excitatriz
15. Anel o-ring
16. Diodo
17. Rolamento traseiro
18. Eixo
19. Carcaça
20. Rotor principal
21. Tela de proteção

Desmontagem

1. Abrir a tampa da caixa de ligação (9) e desconectar os cabos de ligação do regulador de tensão e da excitatriz;
2. Soltar os parafusos que fixam a caixa de ligação (10) na carcaça (19) e retirá-la;
3. Retirar a tela de proteção (21);
4. Soltar os parafusos que fixam o flange dianteiro (4) na carcaça e retirá-lo;
5. Retirar as abraçadeiras e espiral para liberar os cabos do estator principal e da excitatriz;
6. Soltar os parafusos e retirar a tampa defletora traseira (12);
7. Soltar os parafusos que fixam o estator da excitatriz (13) na tampa traseira e retirá-lo, utilizando um martelo de borracha e tomando os devidos cuidados para evitar quedas ou danos nas bobinas do estator e rotor da excitatriz;
8. Retirar o rotor da excitatriz, conforme procedimento descrito no item 6.13;
9. Retire os parafusos que fixam a tampa traseira (11) na carcaça e retire-a com uma alavanca e um martelo de borracha;
10. A retirada do rotor completo deve ser feita pelo lado dianteiro do alternador, utilizando dispositivo apropriado.

Montagem

1. Verificar se as partes usinadas de encaixe da carcaça, do flange, da tampa traseira e da tampa defletora estão limpas e com proteção anti-corrosiva;
2. Inserir o rotor principal pelo lado dianteiro com dispositivo apropriado;
3. Verificar se o anel o-ring (15) está corretamente colocado no assento do rolamento da tampa traseira;
4. Encaixar a tampa traseira (11) no rolamento e fixe-a;
5. Encaixar manualmente o rotor da excitatriz no eixo e fixá-lo com os parafusos apropriados;
6. Conectar os cabos do rotor principal na ponte retificadora do rotor da excitatriz;
7. Fixar o estator da excitatriz (13) na tampa traseira utilizando os parafusos apropriados;
8. Certificar-se de que os cabos de ligação do estator da excitatriz estejam posicionados corretamente para se fazer a ligação na caixa de ligação;
9. Fixar a tampa defletora traseira (12) na tampa traseira;
10. Fixar o flange dianteiro (4) na carcaça;
11. Colocar a tela de proteção (21);
12. Colocar a caixa de ligação (10) na posição correta e fixe-a na carcaça;
13. Fazer as ligações dos cabos do regulador de tensão e da excitatriz, conforme esquema elétrico do alternador e manual do regulador de tensão.
14. Fixar a tampa da caixa de ligação (9).

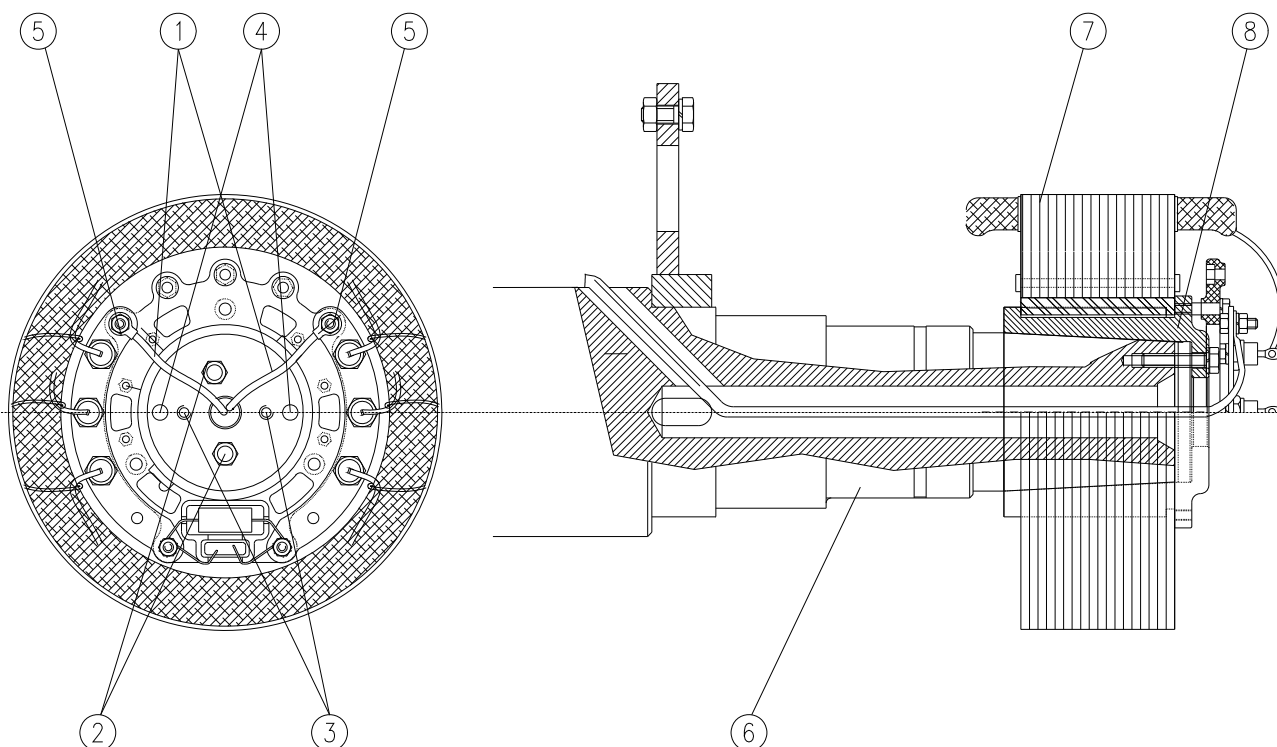


NOTA

- Para desmontagem dos alternadores com mancal duplo (forma construtiva B35T) primeiramente deve-se retirar o flange e a tampa dianteira.
- Antes de desmontar os alternadores fechados tipo GTF deve-se retirar o trocador de calor instalado na parte superior dos alternadores.



6.13 DESMONTAGEM DO ROTOR DA EXCITATRIZ GTA315 a GTA400



Procedimento para sacar o rotor da excitatriz

1. Retirar os parafusos (5) que fixam os cabos de ligação do rotor (1) na roda de diodos e soltar os cabos;
2. Retirar a trava mecânica “meia-lua” dos parafusos de fixação (2);
3. Retirar os parafusos de fixação (2) do rotor da excitatriz;
4. Colocar os 2 parafusos (2) nos furos com rosca (3) e apertar os dois parafusos de forma uniforme “simultaneamente” de forma a forçar a bucha de fixação (8) se soltar do eixo (6) até que a bucha (8) juntamente com o rotor da excitatriz (7) se desprenda e possa ser retirado com a mão.

6.14 PLANO DE MANUTENÇÃO

Verificações e tarefas de manutenção a executar	Diariamente	A cada 250 h	A cada 1.500 h	A cada 4.500 h
Observar ruídos estranhos com o alternador em movimento	X			
Inspecionar a ventilação (fluxo de ar)	X			
Verificar resistência de isolamento		X		
Verificar e reapertar os parafusos e terminais de ligação		X		
Verificar níveis de vibração e ruído		X		
Inspecionar rolamentos		X		
Inspecionar as conexões do regulador de tensão		X		
Limpar o alternador interna e externamente			X	
Inspecionar o funcionamento e ligações dos acessórios			X	
Inspecionar os diodos			X	
Inspecionar varistores (se houver)			X	
Lubrificar os rolamentos ¹				
Trocar os rolamentos ²				
Revisão completa do alternador				X

1. Verificar o intervalo de lubrificação e quantidade de graxa no item 6.5.1 deste manual.

2. A troca do(s) rolamento(s) deve ser efetuada a cada 20.000 horas.



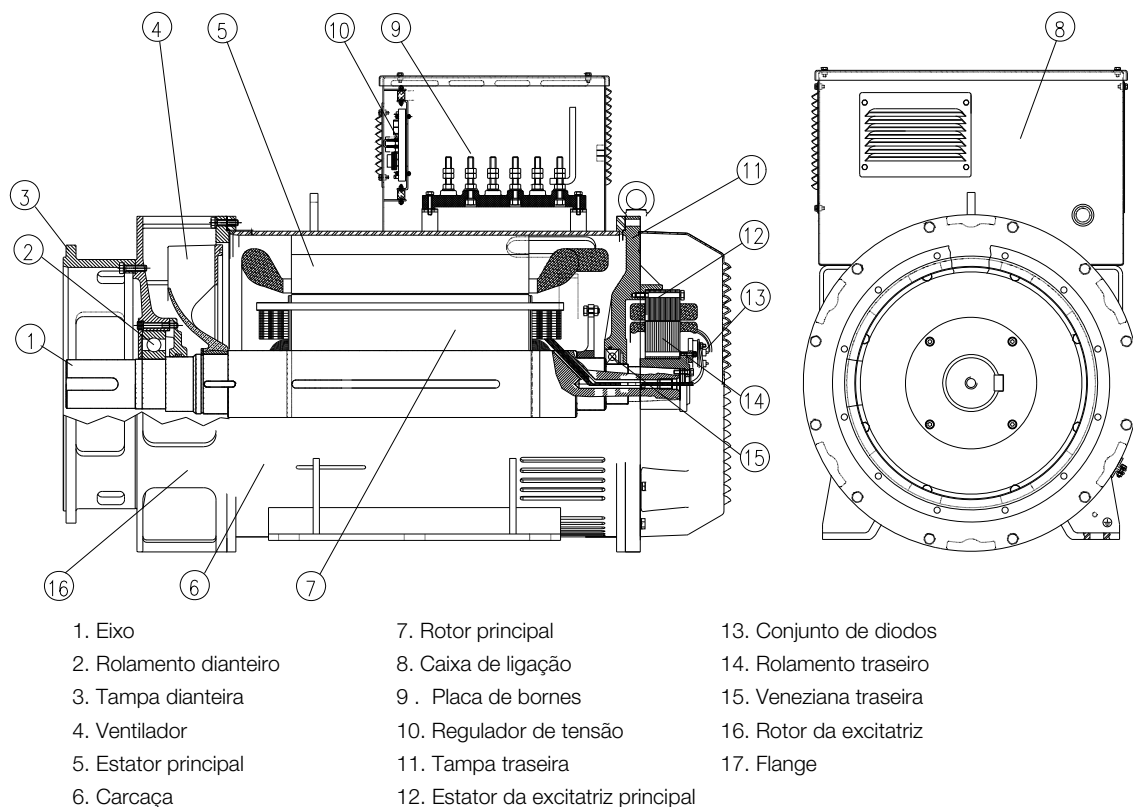
NOTA

As verificações e tarefas descritas na tabela acima devem ser executadas conforme item 6 deste manual.

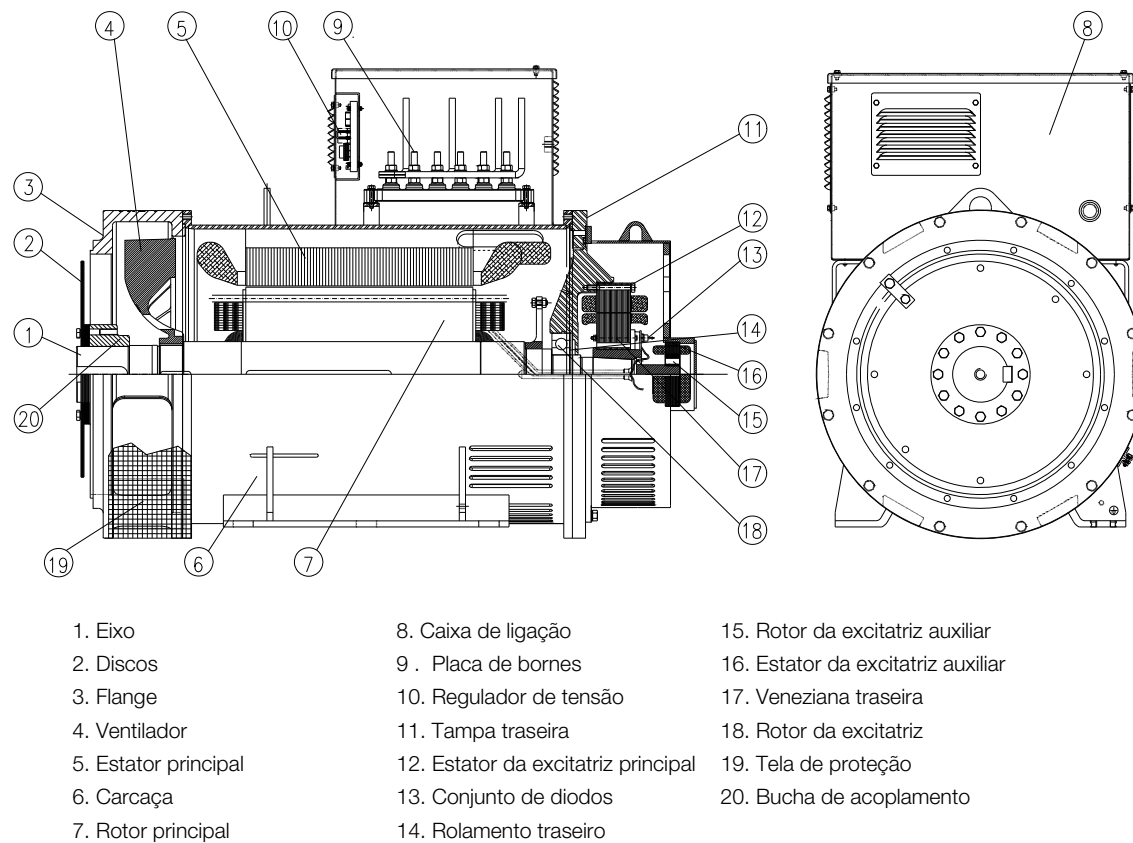


7 LISTA DE PEÇAS (MODELOS ESPECIAIS)

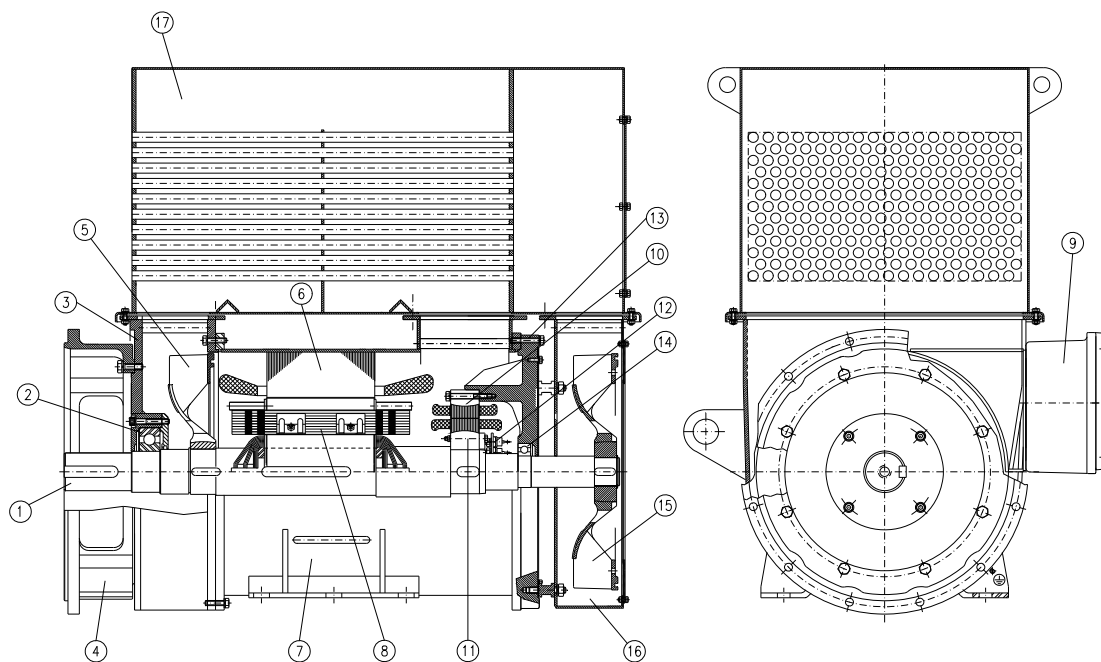
7.1 GTA MANCAL DUPLO (B35T)



7.2 GPA MANCAL ÚNICO (B15T)

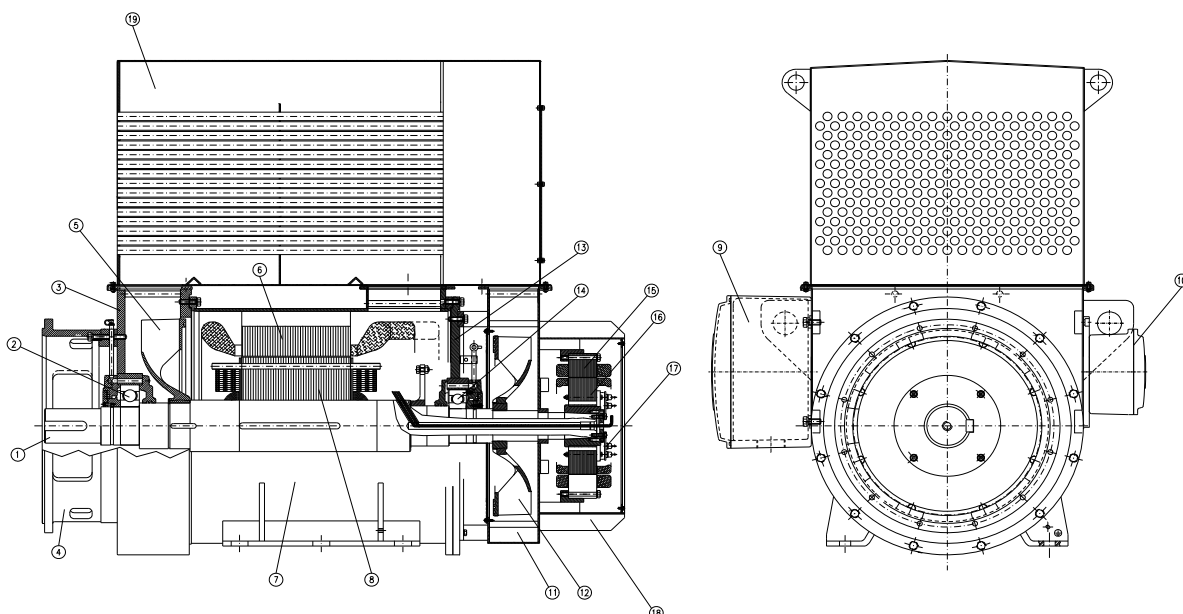


7.3 GTF 200 E GTF250



1. Eixo	7. Carcaça	13. Tampa traseira
2. Rolamento dianteiro	8. Rotor principal	14. Rolamento traseiro
3. Tampa dianteira	9. Caixa de ligação	15. Ventilador externo
4. Flange	10. Estator da excitatriz principal	16. Proteção do ventilador
5. Ventilador Interno	11. Rotor da excitatriz	17. Trocador de calor
6. Estator principal	12. Conjunto de diodos	

7.4 GTF315 A GTF560



1. Eixo	8. Rotor principal	14. Rolamento traseiro
2. Rolamento dianteiro	9. Caixa de ligação	15. Estator da excitatriz
3. Tampa dianteira	10. Caixa de acessórios	16. Rotor da excitatriz
4. Flange	11. Proteção do ventilador	17. Conjunto de diodos
5. Ventilador Interno	12. Ventilador externo	18. Suporte da excitatriz
6. Estator principal	13. Tampa traseira	19. Trocador de calor
7. Carcaça		



8 ANOMALIAS

A seguir são enumeradas algumas anomalias possíveis de ocorrer no alternador em serviço, bem como o procedimento correto para sua verificação e correção.

O ALTERNADOR NÃO EXCITA	
ANOMALIA	PROCEDIMENTO
Interrupção no circuito do enrolamento auxiliar.	Verificar a união dos cabos da bobina auxiliar no bloco de conexão prosseguindo até o bloco de conexão do regulador e fusível.
Fusível queimado.	Trocar o fusível (conforme especificado).
Tensão residual demasiadamente baixa.	Desconectar os cabos do regulador e fazer excitação externa com bateria de 12 a 20Vcc (polo negativo em F- e polo positivo em F+), até o início do processo de excitação. A bateria de partida do motor Diesel não deverá estar aterrada.
Velocidade de acionamento não está correta.	Medir a velocidade e regulá-la
Interrupção no circuito de excitação principal.	Verificar a continuidade dos cabos F+ e F-, fazer medições em todos os diodos e trocar os diodos defeituosos ou trocar o conjunto todo.
Relé ou outro componente do regulador de tensão com defeito.	Trocar o regulador de tensão.
Potenciômetro externo de ajuste de tensão rompido ou ligação interrompida.	Verificar as ligações nos bornes 11-12 e o próprio potenciômetro.
Varistor de proteção dos diodos (quando houver) está defeituoso.	Caso estiver defeituoso, o varistor deve ser substituído, ou se não houver peça de reposição, retirá-lo temporariamente.

ALTERNADOR NÃO EXCITA, ATÉ A TENSÃO NOMINAL	
ANOMALIA	PROCEDIMENTO
Diodos girantes defeituosos.	Trocar o conjunto dos diodos.
Velocidade incorreta.	Medir a velocidade da máquina primária e regulá-la.
Ajuste de tensão abaixo da nominal.	Ajustar no potenciômetro no regulador ou o externo.
Alimentação do regulador de tensão não está de acordo com a tensão de saída desejada.	Verificar se as ligações estão de acordo com o manual do regulador de tensão.

EM VAZIO, O ALTERNADOR EXCITA ATÉ A TENSÃO NOMINAL, PORÉM ENTRA EM COLAPSO COM A CARGA	
ANOMALIA	PROCEDIMENTO
Forte queda de velocidade.	Controlar o seletor Diesel.
Diodos girantes defeituosos.	Trocar o conjunto de diodos.



O ALTERNADOR, EM VAZIO, SE EXCITA ATRAVÉS DE SOBRE TENSÃO

ANOMALIA	PROCEDIMENTO
Tiristor de potência do regulador defeituoso.	▪ Trocar regulador.
Transformador de alimentação do regulador com defeito ou incorreto.	▪ Verificar relação de tensão / funcionamento.
Alimentação do regulador de tensão não está de acordo com a tensão de saída desejada.	▪ Refazer as ligações. Verificar o manual do regulador de tensão.

OSCILAÇÃO NA TENSÃO DO ALTERNADOR

ANOMALIA	PROCEDIMENTO
Estabilidade mal ajustada	▪ Ajustar no trimpot estabilidade do regulador.
Oscilações na velocidade da máquina de acionamento.	▪ As oscilações frequentes são originárias da máquina de acionamento e precisam ser eliminadas.

ANOMALIAS MECÂNICAS

ANOMALIA	PROCEDIMENTO
Aquecimento excessivo do mancal (rolamento).	▪ Rolamento com falha, falta de lubrificação ou folga axial excessiva.
Aquecimento excessivo na carcaça do alternador.	▪ Entrada ou saída de ar parcialmente obstruído ou o ar quente está retornando para o alternador, sobrecarga no alternador ou sobre excitação.
Vibração excessiva.	▪ Desalinhamento, defeito de montagem ou folga no acoplamento.
Queda de tensão acentuada com recuperação posterior: (piscadas).	▪ Ajuste incorreto da estabilidade, alternador operando singelo com sistema de paralelismo ligado ou sobrecarga momentânea.



ATENÇÃO

As máquinas referenciadas neste manual estão em melhoria contínua, por isso as informações deste manual estão sujeitas a modificações sem prévio aviso.



9 GARANTIA

A WEG oferece garantia contra defeitos de fabricação ou de materiais, para seus produtos, por um período de 12 (doze) meses, contados a partir da data de emissão da nota fiscal fatura da fábrica. No caso de produtos adquiridos por revendas/distribuidor/fabricantes, a garantia será de 12 (doze) meses a partir da data de emissão da nota fiscal da revenda/distribuidor/fabricante, limitado a 18 (dezoito) meses da data de fabricação.

A garantia independe da data de instalação do produto e os seguintes requisitos devem ser satisfeitos:

- Transporte, manuseio e armazenamento adequados;
- Instalação correta e em condições ambientais especificadas e sem a presença de agentes agressivos;
- Operação dentro dos limites de suas capacidades;
- Realização periódica das devidas manutenções preventivas;
- Realização de reparos e/ou modificações somente por pessoas autorizadas por escrito pela WEG.
- O equipamento, na ocorrência de uma anomalia esteja disponível para o fornecedor por um período mínimo necessário à identificação da causa da anomalia e seus devidos reparos;
- Aviso imediato, por parte do comprador, dos defeitos ocorridos e que os mesmos sejam posteriormente comprovados pela WEG como defeitos de fabricação.

No caso de alternadores WEG acoplados a motores diesel, formando os chamados grupos geradores, a responsabilidade pela montagem do grupo, no que diz respeito ao acoplamento das máquinas, construção da base, interligação dos sistemas de controle e proteção, e também ao desempenho do conjunto é do montador do grupo.

Em nenhuma hipótese a WEG assumirá garantias sobre partes do grupo-alternador que não sejam de seu fornecimento, nem tampouco cuja causa não seja comprovadamente defeito de fabricação do alternador.

A garantia não inclui serviços de desmontagem nas instalações do comprador, custos de transportes do produto e despesas de locomoção, hospedagem e alimentação do pessoal da Assistência Técnica quando solicitado pelo cliente. Os serviços em garantia serão prestados exclusivamente em oficinas de Assistência Técnica autorizados WEG ou na própria fábrica.

Excluem-se desta garantia os componentes cuja vida útil, em uso normal, seja menor que o período de garantia.

O reparo e/ou substituição de peças ou produtos, a critério da WEG durante o período de garantia, não prorrogará o prazo de garantia original.

A presente garantia se limita ao produto fornecido não se responsabilizando a WEG por danos a pessoas, a terceiros, a outros equipamentos ou instalações, lucros cessantes ou quaisquer outros danos emergentes ou consequentes.



WEG Equipamentos Elétricos S.A.

Jaraguá do Sul - SC

Telefone: (47) 3276-4000

energia@weg.net

www.weg.net



ANOTAÇÕES

[illegible]

[illegible]





WEG Group - Energy Business Unit
Jaraguá do Sul - SC - Brazil
Phone: 55 (47) 3276-4000
energia@weg.net
www.weg.net



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MOT
(MOTOR)
BAUDOUIN
4M06G25/6_G41/6_G50/6
4M10G83/6_G100/6
(C2002)

08	PF	05/12/2023	GONÇALVES	DAVID	FABIANO	UMSAZ	FREDDY	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
07	PF	06/10/2023	DAVID	DAVID	FABIANO	UMSAZ	FREDDY	
06	PF	08/08/2023	DAVID	DAVID	FABIANO	UMSAZ	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	EMISSIONES PADRONIZADAS
 www.stemac.com (51) 2131.3800			CLIENTE: PADRÃO					ESCALA: S/E
			OBRA: PADRÃO					UNIDADE: --
			TÍTULO: BAUDOUIN 4M06G25/6_G41/6_G50/6, 4M10G83/6_G100/6 (C2002) MOTOR VERSÃO SPRINT					PÁGINA: 1 de 4
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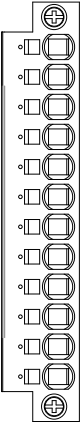
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XP1#1

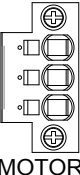


MOTOR

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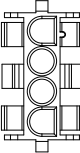


MOTOR

+OPC. PRÉ-AQUECIMENTO

+OPC. PRÉ-AQUECIMENTO

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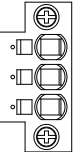


- 1 4/B6 PRÉ-AQUECIMENTO
- 2 4/B6 PRÉ-AQUECIMENTO
- 3 4/B6 TERRA
- 4 Ñ.A.

+OPC. ABASTECIMENTO A082.01

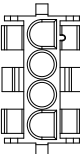
+OPC. ABASTECIMENTO A082.01

XP4#1



- 1 4/D7 SOLENÓIDE COMB.
- 2 4/D7 ANTITRANS.
- 3 Ñ.A.

XS11#1



- 1 4/B7 GND
- 2 4/B7 ANTITRANS.
- 3 4/B7 VCC(+)
- 4 Ñ.A.

+ORIGINAL DO MOTOR

+REG. VELOCIDADE C2002

ARV1	
REGULADOR DE VELOCIDADE C2002	
4/A4 ○ 1	ACTUADOR
4/A4 ○ 2	ACTUADOR
4/A4 ○ 3	PICK-UP
4/A4 ○ 4	PICK-UP
4/A4 ○ 5	BATTERY (-)
4/A4 ○ 6	BATTERY (+)
○ 7	COM
○ 8	NOT USED
○ 9	VARIABLE SPEED INPUT
○ 10	DROOP
○ 11	DROOP
○ 12	IDLE
4/A5 ○ 13	AUX
○ 14	10V

ACTUADOR

ACTUADOR

PICK-UP

PICK-UP

BATTERY (-)

BATTERY (+)

COM

NOT USED

VARIABLE SPEED INPUT

DROOP

DROOP

IDLE

AUX

10V

NOTAS



4/C2
4/C5
2/C1

NÃO APLICÁVEL QUANDO UTILIZADO O CONTROLADOR DS4510 E DS4520.



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07	PF	06/10/2023	DAVID	DAVID	FABIANO	UMSZA	FREDDY	
06	PF	08/08/2023	DAVID	DAVID	FABIANO	UMSZA	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	
 www.stemac.com (51) 2131.3800			CLIENTE: PADRÃO					ESCALA: S/E
			OBRA: PADRÃO					UNIDADE: --
			TÍTULO: BAUDOUIN 4M06G25/6_G41/6_G50/6, 4M10G83/6_G100/6 (C2002) ARQUITETURA DE MÓDULOS VERSÃO SPRINT					PÁGINA: 2 de 4
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CÓDIGO STEMAC: MOT.00000.000.A00500.00P.0								

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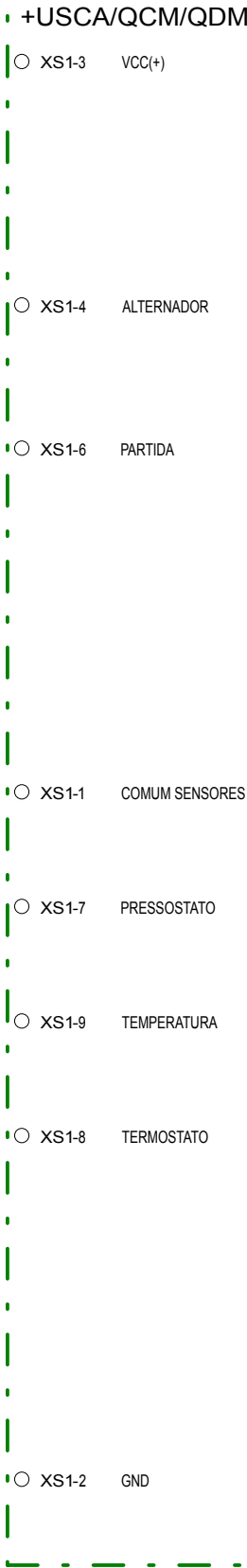
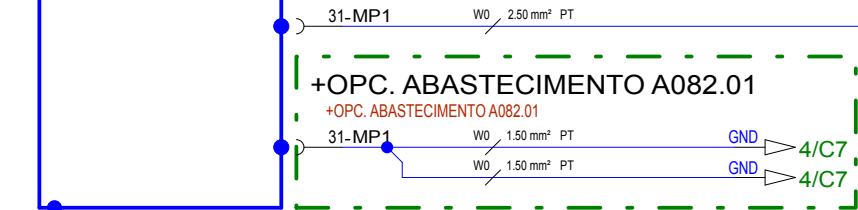
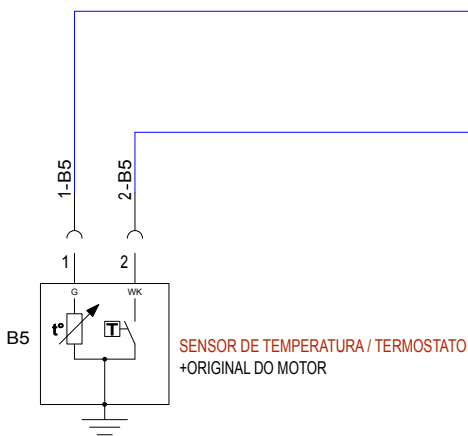
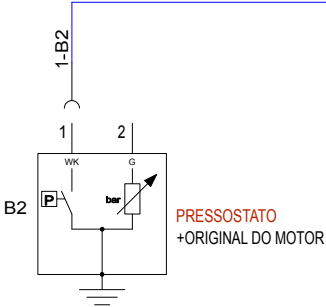
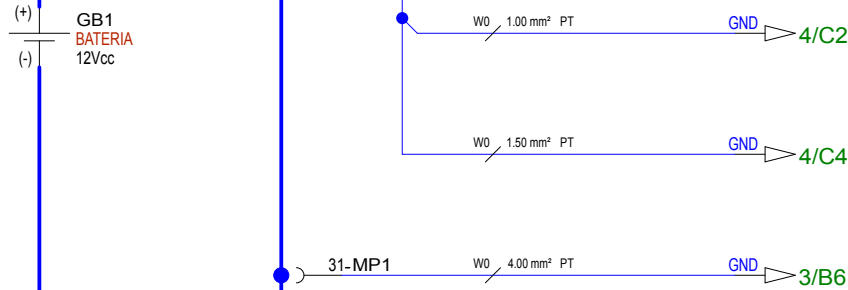
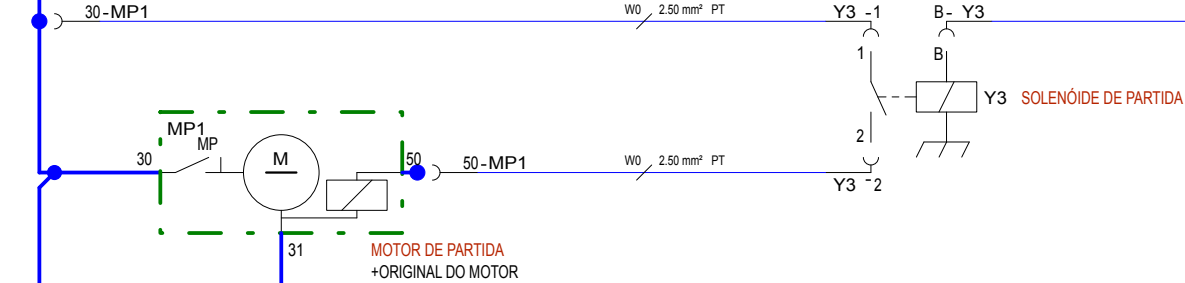
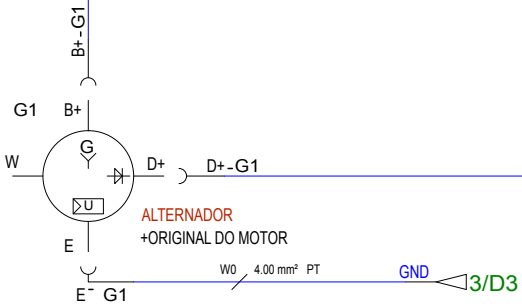
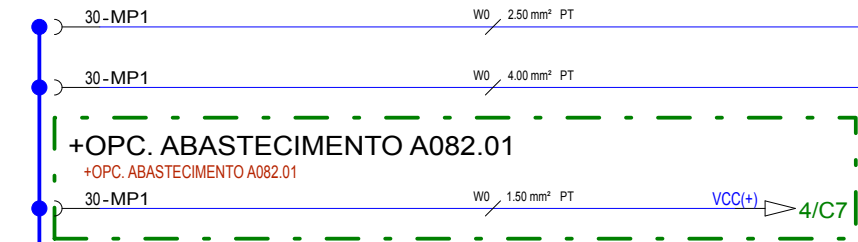
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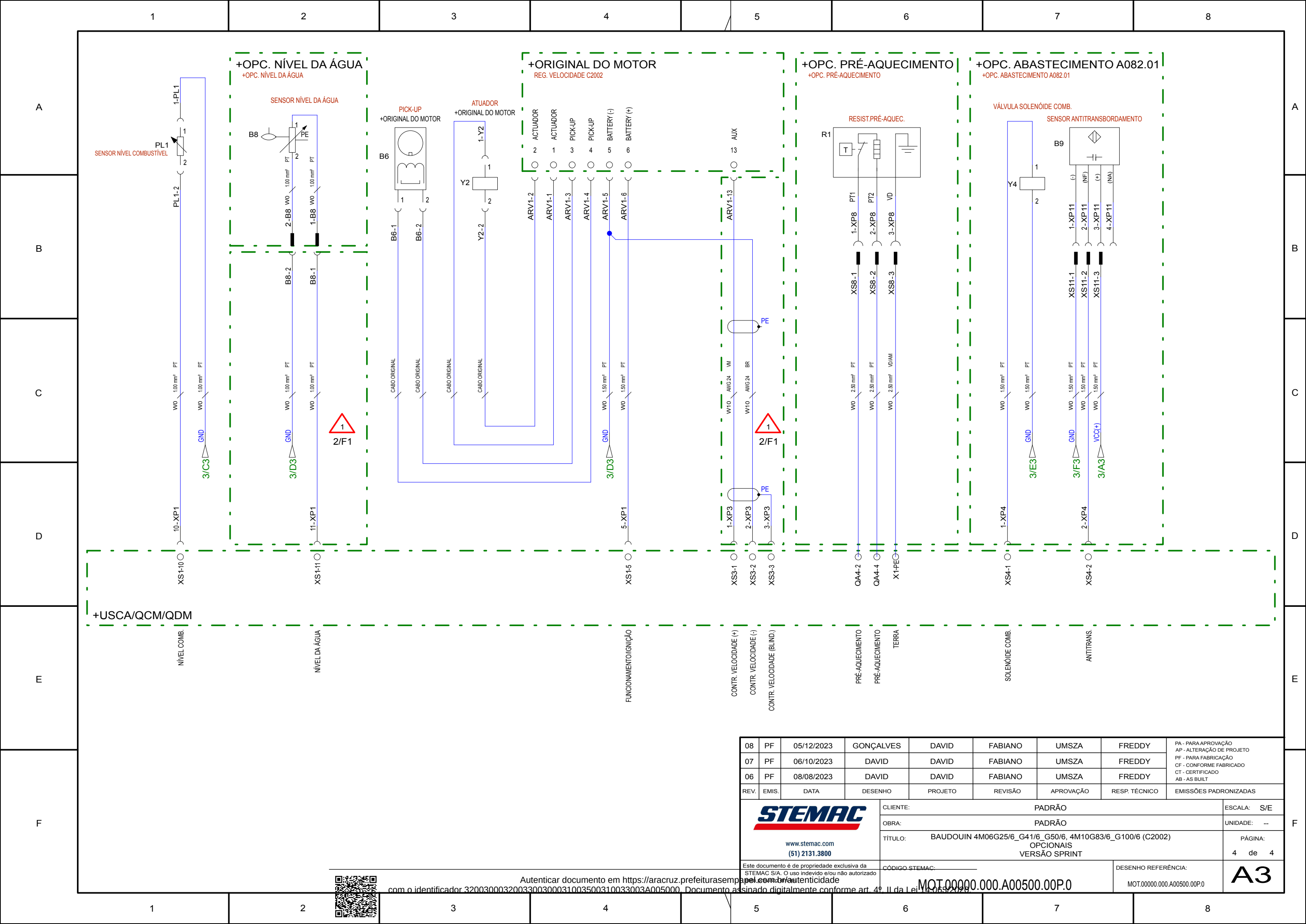


08	PF	05/12/2023	GONÇALVES	DAVID	FABIANO	UMSZA	FREDDY	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
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06	PF	08/08/2023	DAVID	DAVID	FABIANO	UMSZA	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	EMISSIONES PADRONIZADAS
			CLIENTE: PADRÃO				ESCALA: S/E	
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			TÍTULO: BAUDOUIN 4M06G25/6_G41/6_G50/6, 4M10G83/6_G100/6 (C2002) LIGAÇÕES DO MOTOR VERSÃO SPRINT				PÁGINA: 3 de 4	
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08	PF	05/12/2023	GONÇALVES	DAVID	FABIANO	UMSA	FREDDY	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
07	PF	06/10/2023	DAVID	DAVID	FABIANO	UMSA	FREDDY	
06	PF	08/08/2023	DAVID	DAVID	FABIANO	UMSA	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	EMISSIONES PADRONIZADAS
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	Model : 4M06G50/6	Date : 11/05/20
	PowerKit Engine Datasheet	Page : 1 / 4

Ratings

RPM	Gross Engine Output		Net Engine Output	
	PRP kWm	ESP kWm	PRP kWm	ESP kWm
1800	53	58	51.2	56.2

Basic data

Engine model	4M06G50/6
N° of Cylinders / Valves	4 / 8
Cylinders arrangement	In line
Bore x Stroke (mm)	89 × 92
Displacement (L)	2.3
Thermodynamic Cycle	Diesel 4 stroke
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	Mechanical Pump
Aspiration	Turbocharged and Aftercooled
Compression ratio	17.5 : 1
Flywheel housing	SAE 3
Flywheel	11.5"
N° of teeth on flywheel ring gear	128
Inertia of flywheel (kg•m ²)	0.47
Inertia of crankshaft (kg•m ²)	0.039
Emission standard	N/A
Overall Dimensions with radiator (Length x Width x Height) (mm)	1175 × 681 × 797
Engine dry weight without radiator and without radiator pipes (kg)	\
Engine dry weight with radiator and radiator pipes (kg)	274
Engine wet weight with radiator (includes oil, coolant) (kg)	295

DPK-TDS-EN-4M06-0058-20-05-11 Moteurs Baudouin reserve the right to modify these specifications, without notice. Document not contractual.

	Model : 4M06G50/6	Date : 11/05/20
	PowerKit Engine Datasheet	Page : 2 / 4

Air intake system

Air intake temperature rise (°C)	≤ 5
Air intake restriction clean filter (mBar)	≤ 35
Air intake restriction dirty filter (mBar)	≤ 60
Recommended air flow @ PRP (m³/min)	3.06
Recommended air flow @ ESP (m³/min)	3.36
Min. diameter of intake pipe (mm)	50

Aftercooling system

Aftercooler system type	Air to Air
Aftercooler heat dissipating capacity @ PRP (kJ/s)	9.2
Aftercooler heat dissipating capacity @ ESP (kJ/s)	10.4
Max. intake temperature @ 25°C ambient temperature (°C)	55
Max. difference between intake temperature and ambient temperature (°C)	≤ 30
Max. intake pressure drop of aftercooler (mBar)	80

Lubrication system

Oil capacity Low / High (L)	7.1 / 9.5
Oil pressure in normal condition idle speed (Bar)	≥ 1
Oil pressure in normal condition at 1800 Rpm @ PRP (Bar)	2 - 5
Lowest oil pressure alarm (shutdown) (Bar)	1
Max. oil temperature (°C)	115
Oil flow (L/min)	22
Oil fuel consumption ratio based on engine fuel consumption data	≤ 0.4 %
Total system capacity (including filters) (L)	11.5

Heat balance test data (with ambient temperature 28 °C)

Total heat dissipation @ ESP (kJ/s)	86.7

Exhaust system

Max. exhaust back pressure (mBar)	80
Max. exhaust temperature before turbocharger (°C)	≤ 700
Max. exhaust temperature after turbocharger (°C)	≤ 650
Exhaust flow @ PRP (m³/min)	10.38
Exhaust flow @ ESP (m³/min)	11.88
Min. diameter of exhaust pipe (mm)	50
Max. bending moment of exhaust gas exit flange (Nm)	10

	Model : 4M06G50/6	Date : 11/05/20
	PowerKit Engine Datasheet	Page : 3 / 4

Cooling system with standard radiator version 2020

System designed for ambient temperature up to (°C) ¹	50
Radiator type	Mechanical
Fan type	Belt driven pusher
Min. inside diameter of coolant outlet pipe (mm)	32
Coolant capacity of radiator and pipes (L)	3.4
Coolant alarm (shutdown) temperature (°C)	105
Thermostat opening temperature / full open temperature (°C)	72 / 82
Min. pressure in cooling system (Bar)	0.15
Coolant capacity of the engine (L)	5
Cooling fan airflow (m³/min)	130
Max additional restriction - Duct allowance (Pa)	50

Fuel system

Governor	Electronic
Governor steady state speed stability at constant load (ISO 8528-5 Class G3)	≤ +/- 0.5 %
Max. restriction at fuel pump inlet (Bar)	0.5
Max. fuel return restriction (Bar)	0.5
Max. fuel inlet temperature (°C)	70
Fuel supply flow (L/hr)	45
Min. pressure of fuel pump (Bar)	1.3
Min. diameter of inlet pipe (mm)	10
Min. diameter of return pipe (mm)	10

Electrical system

Electrical system voltage (negative to ground) (Vdc)	12
Starter power (kW)	3.7
Battery charger current (A)	55
Battery charger absorbed power (kW)	0.8
Max. electric resistance of starting circuit (Ω)	0.004
Min. sectional area of wire (mm²)	50
Min. cold start temperature without auxiliary starting device (°C) ²	- 5
Min. cold start temperature with auxiliary starting device (°C) ²	- 15

¹ The indicated value is based on an AOT value of 50°C for an engine tested at 100% of the PRP Power, in an open condition, without an enclosure or container, without any airflow obstruction in the front of the radiator, without air recirculation, with free exhaust gas exit and with the engine thermostatic valve in its full open condition, without a closing plate present.

² Engines used in emergency standby application or application that require immediate start under load, must be equipped with coolant heaters. Baudouin recommend heaters installation to be executed by providing constant coolant circulation across all the engine components. Two heaters are required for V-type engines, one per each side.

	Model : 4M06G50/6	Date : 11/05/20
	PowerKit Engine Datasheet	Page : 4 / 4

Performance data

Mean Piston Speed (m/s)	5.5
BMEP (Bar)	16.81
Fan absorbed power (kW)	1

Noise

Diesel engine noise (Acoustic power level) (dB(A))	107.6
Noise - upper side (dB(A))	91.9
Noise - right side (view from flywheel) (dB(A))	91.2
Noise - left side (view from flywheel) (dB(A))	94.7
Noise – front (radiator) side (dB(A))	94.6
Noise – rear (flywheel) side (dB(A))	95.4

Notes :

- Noise test made at 100% of the ESP power, at 1 mt. distance, on engine without radiator, without cooling fan and without silencer.
- Noise test refers to GB/T 1859 norm : "Reciprocating internal combustion engines. Measurement of emitted airborne noise. Engineering method and survey method".

Fuel consumption

Rating	gr/kWh	L/hr
100% ESP	208.5	14.4
100% PRP	207.7	13.1
75% PRP	202.3	9.6
50% PRP	213.1	6.7
25% PRP	236.6	3.7
Fuel consumption tolerance + 3 %		

Ratings definitions

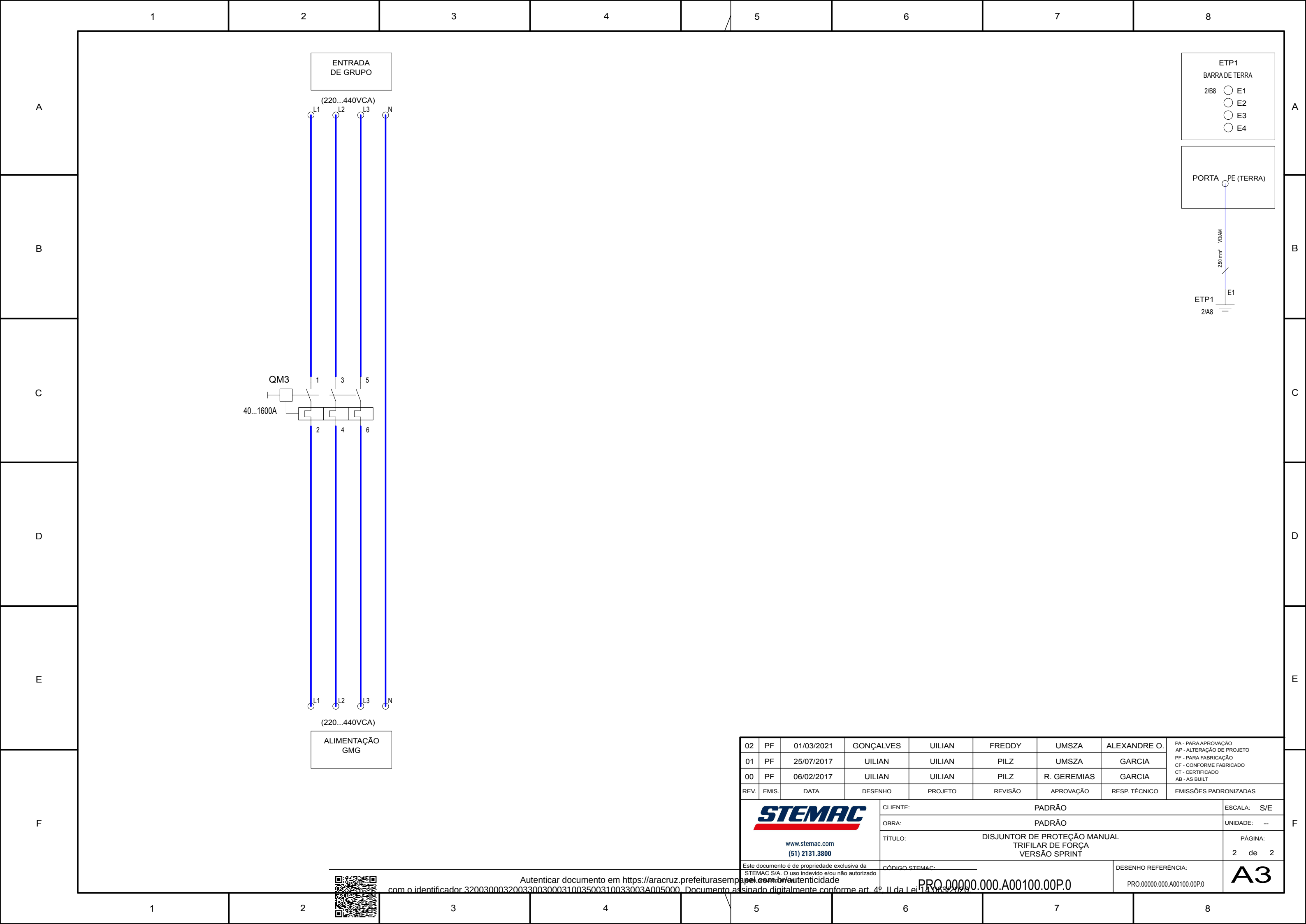
Emergency Standby Power (ESP)

Emergency Standby Power is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating. Typical operational hours of the engine is 200 hours per year, with a maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

Prime Power (PRP)

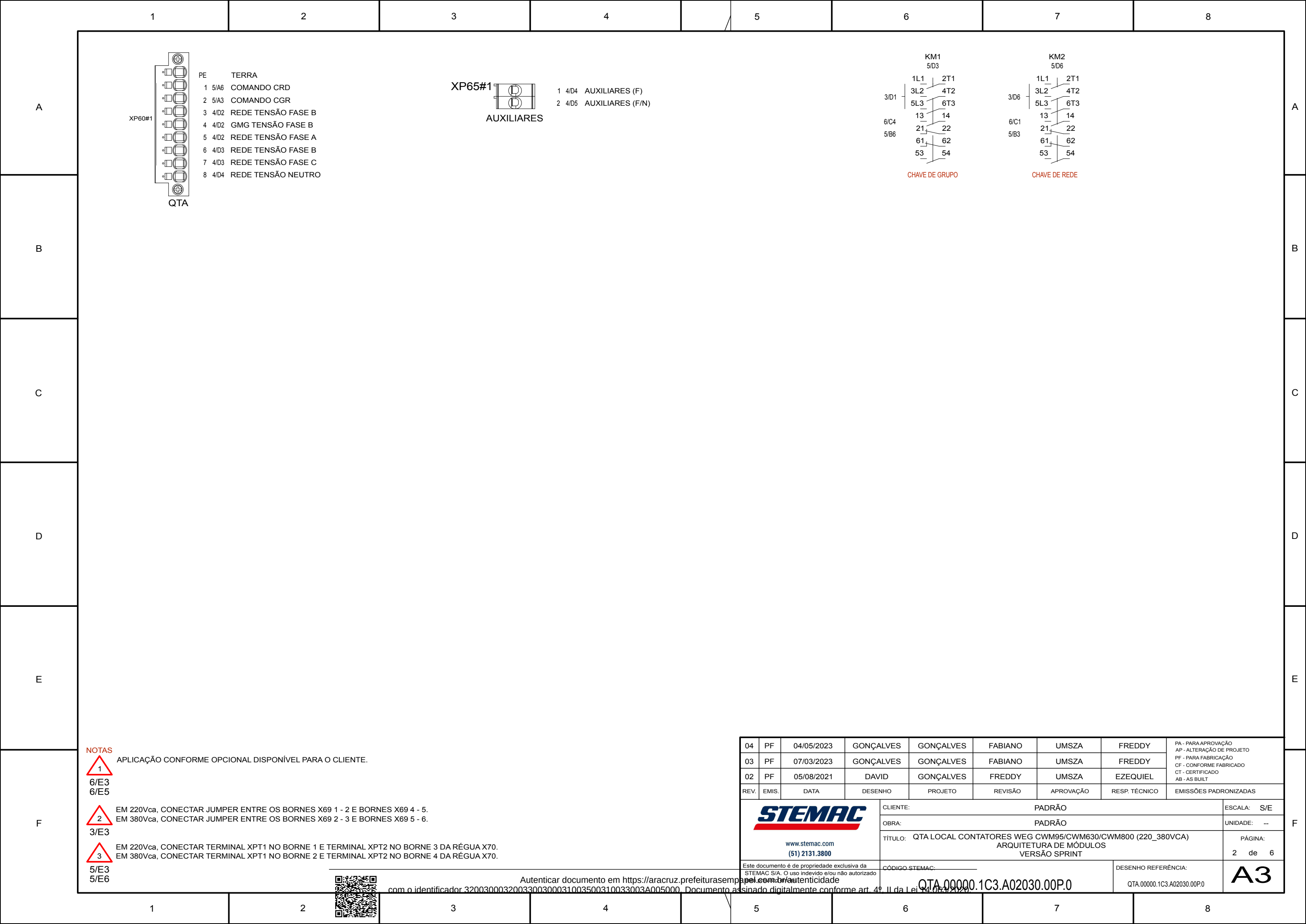
Prime Power is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24 hour period. An overload capability of 10% is available, however, this is limited to 1 hour within every 12 hour period.

- All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of $\pm 5\%$.
- Test conditions : 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.
- Power output curves are based on the engine operating with fuel system, water pump and lubricating oil pump; not included are battery charging alternator, fan and optional equipment.



02	PF	01/03/2021	GONÇALVES	UILIAN	FREDDY	UMSZA	ALEXANDRE O.	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
01	PF	25/07/2017	UILIAN	UILIAN	PILZ	UMSZA	GARCIA	
00	PF	06/02/2017	UILIAN	UILIAN	PILZ	R. GEREMIAS	GARCIA	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	
 www.stemac.com (51) 2131.3800			CLIENTE: PADRÃO					ESCALA: S/E
			OBRA: PADRÃO					UNIDADE: --
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A	QTA (QUADRO TRANSFERÊNCIA AUTOMÁTICA) QTA LOCAL S/ STR CONTADORES WEG 3P CWM95/CWM630/CWM800 (140A/900A/1050A, 220_380VCA)							A																																																																					
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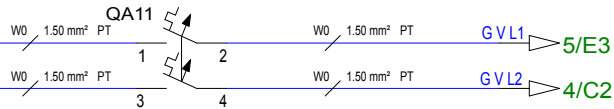
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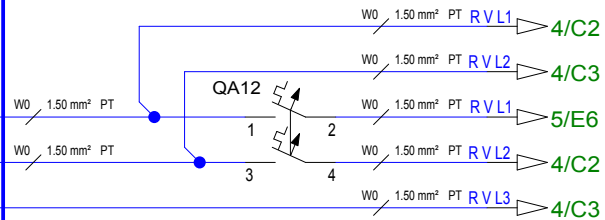
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CONCESSIONÁRIA

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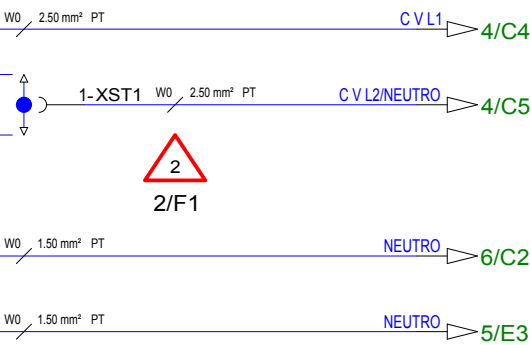


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2T1 4T2 6T3

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KM2
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2T1 4T2 6T3



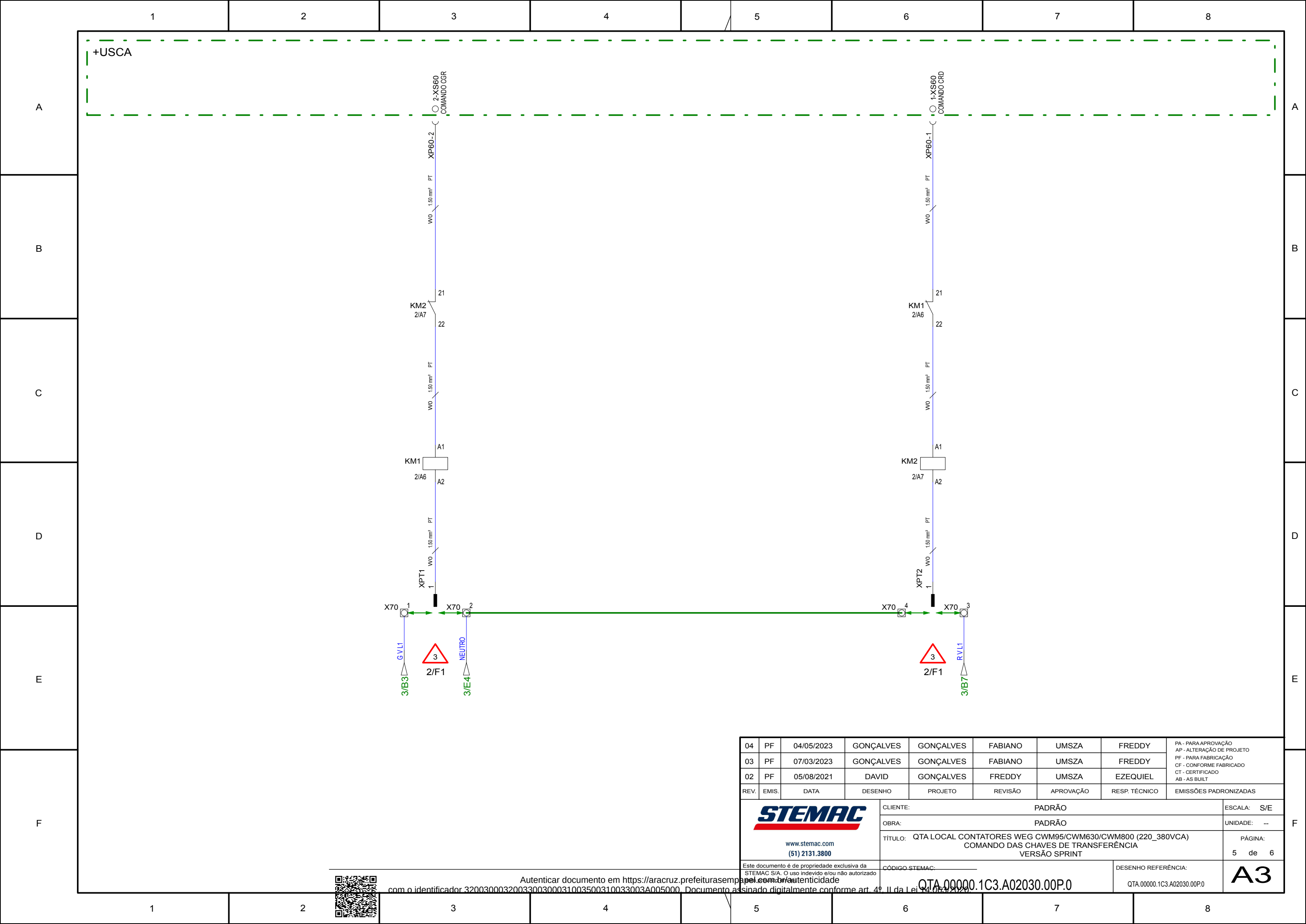
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Relatório de Assistência Técnica

Nº OS: 7471885 - 0010

RQ – 28.03

Dados do Cliente

Cliente: 1351452 ENVIX ENGENHARIA LTDA

Pessoa do Contato: Alexandra Andrade Cardoso

Obra: ENVIX ENGENHARIA LTDA

Telefone: (27) 3327-0608

Endereço: ENDEREÇO OBRA: RUA LUCIA BITTI DEVENS , S/N Aracruz / ES

E-mail: alexandra@engevixengenharia.com.br

Dados do Equipamento

Nº Stemac: A0055004124

Motor: WEI_BAUD

Modelo: 4M06G50_6

Nº: BJ11299347

Gerador: WEG

Modelo: GTA_201A120_B15T

Nº: 1096700647

Potência KVA: 55

Quadro: DS4520

Hrs Funcionamento: 0

Ligado em: 220 - 60

Dados do Atendimento

Técnico: ROMULO OLIVEIRA ARAUJO - 21937

Classificação do Atendimento: Entrega Técnica

Horário: De 22/10/2024 07:55 até 22/10/2024 10:05

Regime Operação: Emergência

Comentários do Técnico:

Motor Bauduin Realizado o procedimento de entrega técnica conforme check list padrão Stemac S.A Grupos Geradores, sendo verificados os seguintes itens: -> Existência de alarmes ativos na USCA DSE 4520 MKII; ->Nível de Óleo lubrificante no cárter do motor; -> Vedação da junta do cárter do motor Bauduin. -> Vedação dos retentores dianteiro e traseiro do motor; -> Motor de Arranque; -> Bomba injetora BY e Bicos injetores; -> Filtros de óleo lubrificante e de combustível; -> Bomba de transferência manual de combustível; -> Alternador de Corrente Contínua; -> Tensionador da correia da ventoinha; -> Correia da ventoinha; -> Cubo da hélice; -> Pás da hélice; -> Grade de proteção da ventoinha; -> Radiador e colmeia; ->Tanque de expansão do radiador; -> Mangotes e abraçadeiras metálicas do sistema de arrefecimento do motor; -> Coletor de admissão de ar; -> Filtro de ar; -> Sistema de Intercooler; -> Turbina; -> Sensores de proteção do equipamento; -> Bateria estacionária de 100 A/h (uma unidade); ->Unidade Alternada; -> Baseta de fechamento; ->AVR Reguladora de Tensão; -> Chicote elétrico em C.C.; -> Chicote elétrico em C.A; -> Cabos de potência do gerador; ->Coxins Anti vibratório; -> Atenuador; -> Flexível do escape; -> Resistência de pré-aquecimento; -> Chapa defletora de calor do Escape, -> Governador Eletrônico C2002 Speed Controller; -> Placa Eletrônica Phoenix Contact de Gerenciamento do motor ; -> Flutuador de bateria; -> Válvula de dreno do cárter. Realizado Start-Up do equipamento e feito teste operacional a vazio e com carga plena, sendo aprovado em todos os procedimentos operacionais. Equipamento deixado em modo automático e disponível para operação.

Assinatura do Técnico:

Fotos



Regulador Eletrônico de velocidade ok



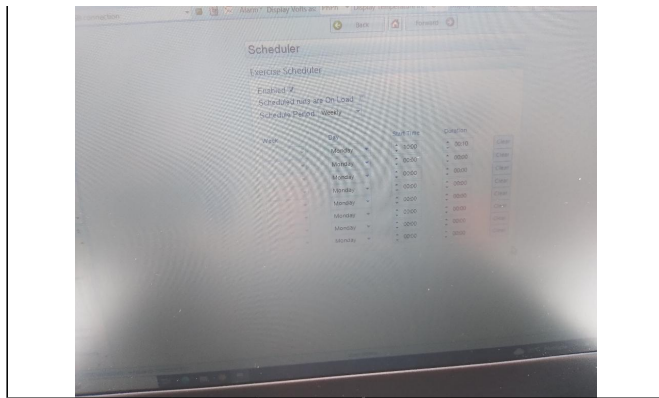
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Visão Geral



Parametrização de Partida Programada para gostaria Quarta-feira das 10:00 às 10:10 à vazio



Etiqueta de Instalação do equipamento



Interior do Painel limpo e organizado



Evidência 2



Evidência 1



Etiqueta da Resistência de Pré-aquecimento



Etiqueta do equipamento





Etiqueta do GG



Nível do líquido de arrefecimento do bloco motor OK



Banco de Bateria do grupo Gerador Instalada.

Dados da Pessoa que Acompanhou o Atendimento

Nome: Alexandra Andrade Cardoso

Documento: CPF - 10461692708

E-mail: alexandra@engevixengenharia.com.br

Comentários do Cliente:

Assinatura do Cliente:

Sintoma – Causa – Solução

Sintoma(s):

Entrega técnica

Causa(s):

Causa Elétrica Não Identificada

Solução(ões):

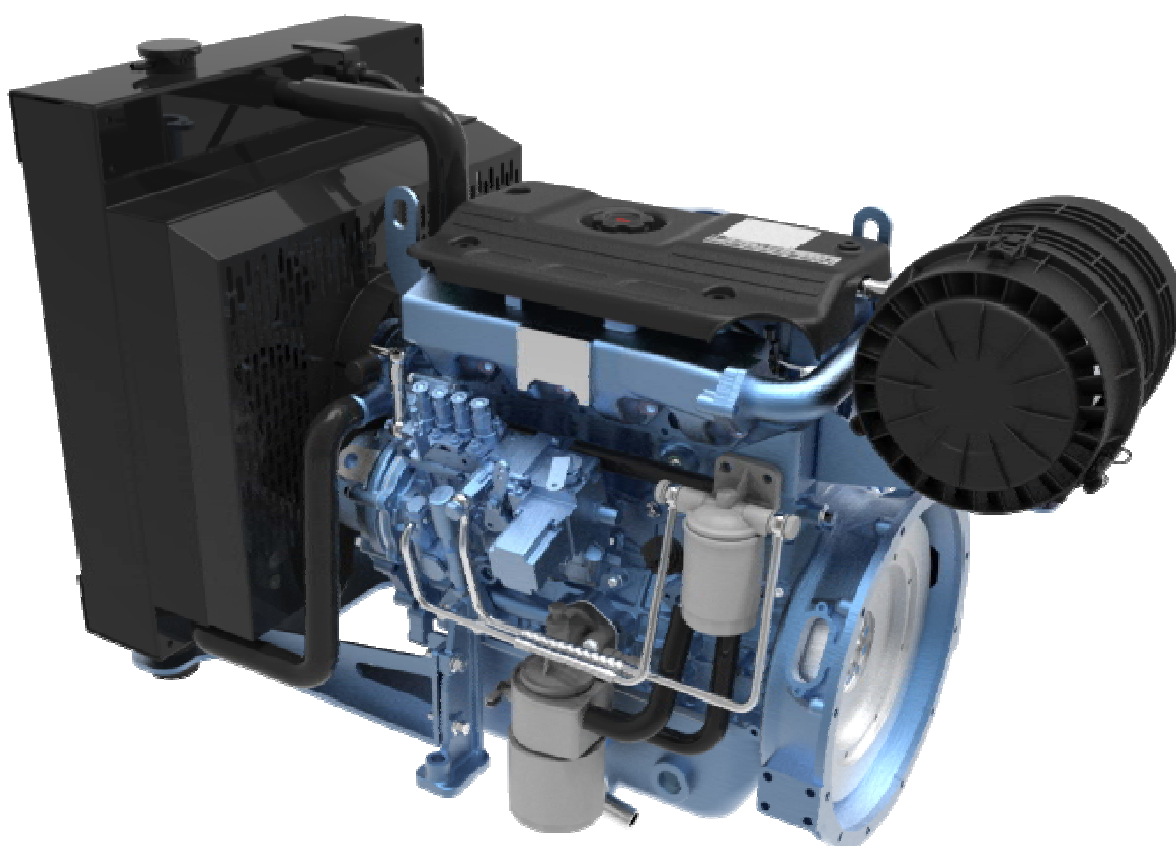
Levantamento Técnico

Caso não seja possível realizar testes no grupo gerador com carga acima de 50% devido a limitações do cliente, eventuais atendimentos posteriores para parametrização e ajustes serão passíveis de cobrança.



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Maintenance Instructions for 4M06 Diesel Engine for Industrial Power



 **MOTEURS Baudouin®**



Preface

4M06 non-road Stage II series diesel engine is a type of high-speed diesel engine independently developed by Weichai Power Co., Ltd., and manufactured by Weichai Power Yangzhou Diesel Engine Co., Ltd. This series of diesel engine has characteristics such as compact structure, reliable use, excellent power, economy and emission and other technical indicators, rapid start-up, easy operation and convenient maintenance, etc.

These instructions introduce operation and maintenance method and key points for overhaul of 4M06 non-road Stage II series diesel engine, for your reference. To make the 4M06 non-road Stage II series diesel engine serve you better, and give full play of its utility, please learn about the structure of diesel engine in detail, and command the maintenance and usage. If you can carefully do the maintenance according to the regulations, the service life of diesel engine will be extended greatly.

With continuous increase and improvement of variants of 4M06 non-road Stage II series diesel engine, we hope you can timely pay attention to all technical information released by our company. The after-sales service is uniformly authorized to and carried out by Weichai Power Co., Ltd., users can acquire relevant product information by visiting the website: <http://www.weichai.com>.



Distinguished users:

Welcome to use Weichai products! Thank you for your great kindness towards Weichai products!

For your correct operation and maintenance of the engine, please carefully read the operation and maintenance instructions, and operate it strictly according to relevant regulations.

Service Commitments:

In case of engine fault, please contact with Weichai Call Center--400-6183066 as soon as possible.

Our company commits to arrive at fault scenes in the city where our special service center locates in 3 hours, fault scenes in ordinary areas in 24 hours and fault scenes in remote areas in 48 hours, and provide fast, quality and considerate services according to service requirements.

In order to ensure effective and normal running of your engine, before using the products of our company, please carefully read the content below:

- In order to protect your legal interests, it is strictly forbidden to uncover the oil pump lead seal privately.
- It is required to do running-in of complete engine and operate the engine according to the regulations in these instructions, and come to "Three Guarantees" places appointed by our company for "Mandatory Service" with specified period (or trip distance).
- It is not allowed to stop the engine running at high speed or with full load suddenly, instead, the engine should be stopped after running at idle speed for several minutes.
- Before every start-up of the diesel engine, it is required to check if it has been filled up with coolant, and if enough oil has been added.
- It is required to use the fuel, oil and coolant according to these instructions.
- Connecting parts of air intake pipeline must be sealed well, and there should not be any crack, sand hole or damage on all kinds of pipes. There should not be any leakage in the whole air intake system.
- The periodical technical maintenance of diesel engine includes First-level Technical Maintenance, Second-level Technical Maintenance and Third-level Technical Maintenance. Only by strictly implement the maintenance specifications can we ensure the engine running at optimum working conditions and can its service life be extended.
- As a result of large number of product types of our company, the after-sales service of products is subject to the order number on name plate.
- The oil seal period of engine is usually one year, any exceeding one year should be checked and necessary complementary measures should be taken on it.
- For overhaul and repair, please come to service stations appointed by Weichai Power, and the spare parts used must be appointed by Weichai Power, therefore, Weichai will not bear the



responsibility for engine damage caused by using non-appointed spare parts.

	Before using the engine, it is required to read these instructions.





Safety Warning

This sign is the “Safety Warning Sign” in industry, which is used to emphasize the importance of information below.

Confirm that you have known about the consequences caused by dangerous situations and the methods to avoid those dangers.

However, the warning information in these Instructions cannot cover all possible situations.

If the program and method you have decided to use are with the recommended range, please make sure this operation will not bring any danger to you or others or the equipment.



This warning sign indicates a potential dangerous situation, if it fails to avoid this situation, serious injury, even death or larger property loss can be caused.

This warning sign indicates a potential dangerous situation, if it fails to avoid this situation, serious injury, even death or larger property loss can be caused. This warning sign is also used for warning of dangerous operation.

The information provided in these notes is used for instructing how to operate and install the product in a right way. However, all these dangerous situations cannot be eliminated by simply reading this document. Only correct understanding of the information included in these notes can help to use it in the right way.

Before maintenance or repair, please note:

- Avoid long time and repeated contact with the used oil.
- If you can, please wear protective clothing, and wear waterproof gloves.
- Please do not put oil stained rag into pockets of clothing.
- Avoid oil or liquids from contaminating clothing, especially underwear.
- Wash the uniforms frequently. Discard the clothing and shoes stained with oil and liquids which cannot be cleaned up.
- If cut or injured, please take emergency measures immediately.
- Before work, be sure to use protective cream; it will make oils and liquids easier to eliminate when skin is contaminated with mineral oil.
- Use soap and hot water, or use hand sanitizer and nail brush to wash hands in order to eliminate all oil stains. If grease naturally secreted by skin is washed off, products containing lanolin can replace the grease secreted by skin, which is helpful for moistening skin.
- Gasoline, kerosene, fuel, thinner or solvent shall not be used to clean skin.
- If it feels discomfort of skin, please see the doctor immediately.
- If possible, remove oil from parts before transportation
- When both eyes are endangered, please use goggles or face shield. Eye flushing fluids should



be prepared at a place near at hand.

- When repairing the engine, oils and fluids shall not be splashed onto the ground. If hydrocarbon or any other fluid leaks by accident, take all necessary measures to isolate this area in order to remain the environment clean and protect staff against injuries.
- Transportation, storage and reclamation of hydrocarbon, ethylene, glycol or petroleum must comply with the safety and environmental standards implemented by the country where the operation is carried out.



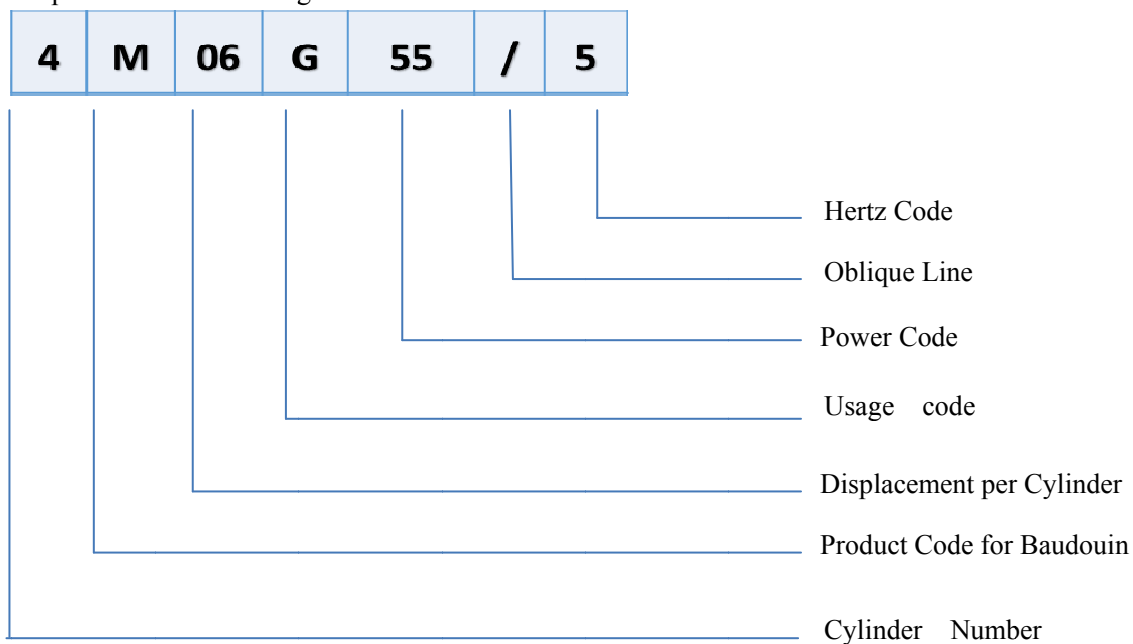
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1. Structure and performance parameters of diesel engine

1.1 Implications of diesel engine model



Usage code: G—Land Power Generation

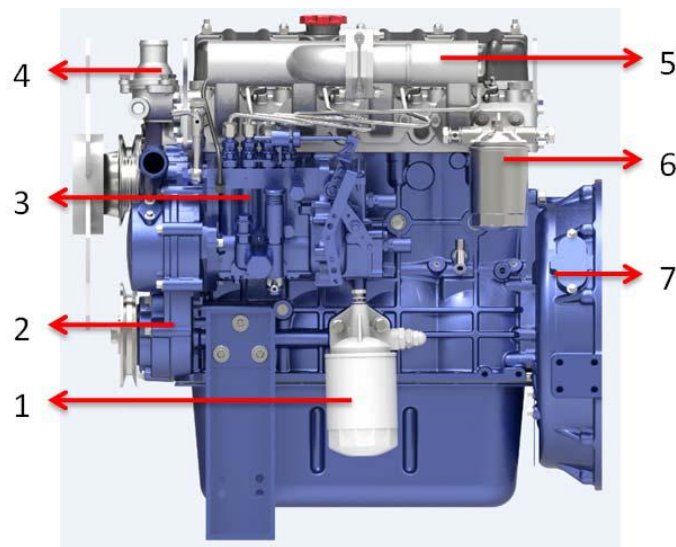
Power Code: for 50Hz correspond standby power(kVA) of generating set.

Power Code: for 60Hz correspond prime unlimited time power (kW) of generating set.

Hertz Code: 5—50Hz, 6—60Hz



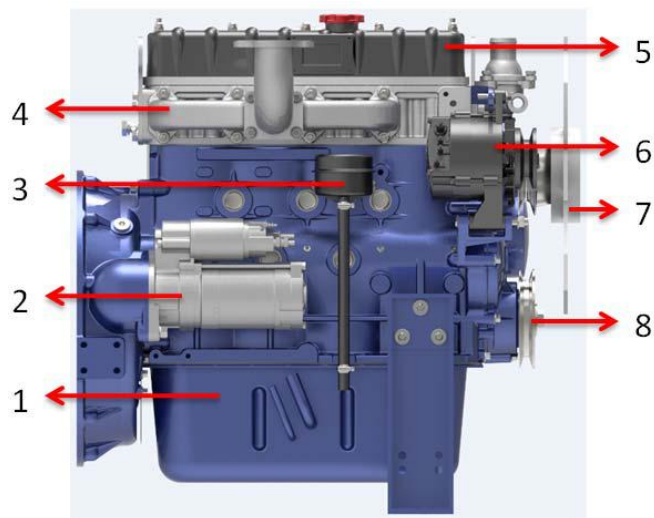
1.2 Introduction to overall dimensions and structure of diesel engines



1—Oil filter 2—Gearbox 3—Fuel injection pump 4—Thermostat

5—Air inlet pipe 6—Fuel filter 7—Flywheel casing

Figure 1-1 Air Intake Side of 4M06 Non-road Stage II Series Diesel Engine

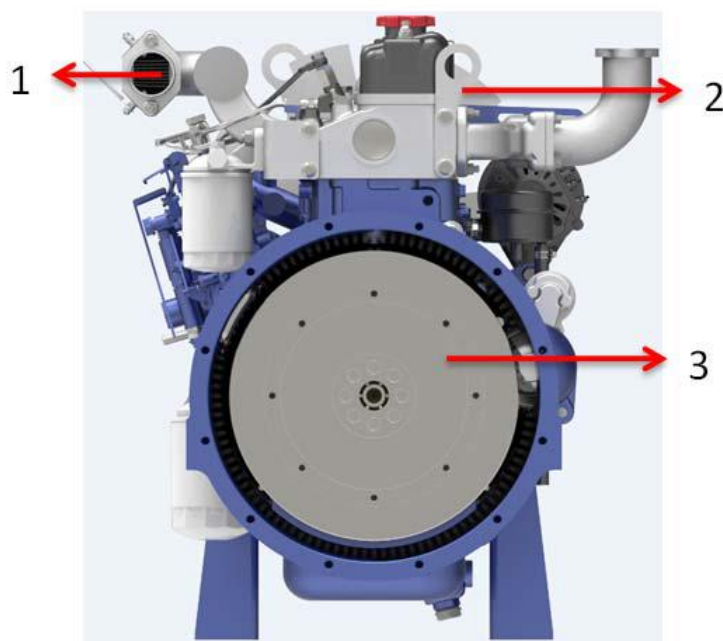


1—Oil pan 2—Starter motor 3—Breather 4—Exhaust manifold

5—Cylinder head cover 6—Alternator 7—Fan 8—Idler

Figure 1-2 Exhaust Side of 4M06 Non-road Stage II Series Diesel Engine





1—Intake connecting pipe; 2—Eye ring; 3—Flywheel and ring gear

Figure 1-3 Front View of 4M06 Non-road Stage II Series Diesel Engine

1.3 Main technical parameters of diesel engines

For model, power, speed, identification number, weight and other information of the engines, please refer to nameplates of engines!

Other performance parameters are given in the following table:

Item	Unit	Type
Engine type	—	inline, water-cooled, four-stroke, direct injection type
Number of cylinders	—	4
Bore × stroke	mm×mm	89×92
Displacement	L	2.3
Power range	kW	23~58
Minimum fuel consumption rate	g/(kW·h)	205
Oil/fuel consumption ratio	%	≤0.4
Crankshaft rotation direction (see from the free end)	—	Clockwise
Starting method	—	Electric starting
Allowable long-term tilt angle	°	7

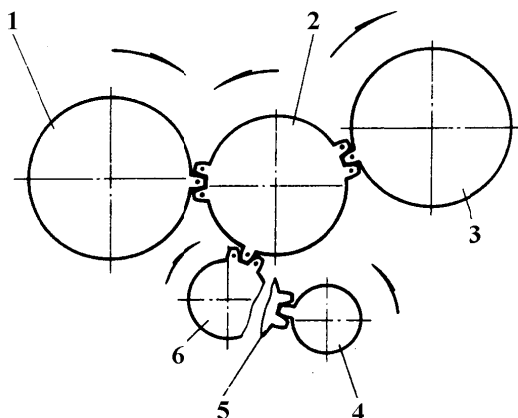


2. Introduction to structure and systems of diesel engines

2.1 Gear system and valve mechanism

The valve mechanism comprises camshaft gear, camshaft, tappet, push rod and valve train, and it adopts a structure of overhead valve and underneath camshaft.

Camshaft gear 1 is driven by crankshaft gear 6 through idle gear 2, and crankshaft gear 6 also drive fuel injection pump 3 through idle gear 2. The gears should be assembled according to the paired engagement marks. Each gear is marked with “.”, and the gears must be assembled with “.” marks aligned to ensure that the valve timing and fuel supply time are correct, as shown in Figure 2-1.



1. camshaft timing gear 2. timing idle gear 3. fuel pump timing gear
4. oil pump gear 5. oil pump driving gear 6. crankshaft timing gear

Figure 2-1 Structure of Gear Train

Driven by the camshaft gear, the camshaft controls the opening and closing of intake and exhaust valves according to certain valve timing through the tappet and push rod.

2.2 Lubricating system

Lubricating system consists of oil strainer, oil pump, oil filter and all internal pipes.

The diesel engine adopts a combined lubrication method: pressure lubrication and splash lubrication. For crankshaft main bearing, connecting rod bearing, camshaft bearing and rocker arm bearing and other parts, pressure lubrication is adopted. Besides, some kinematic pairs, such as cylinder liner and piston, piston pin and connecting rod, and piston pin seat, valve and valve guide, gear and other parts rely on splash lubrication.

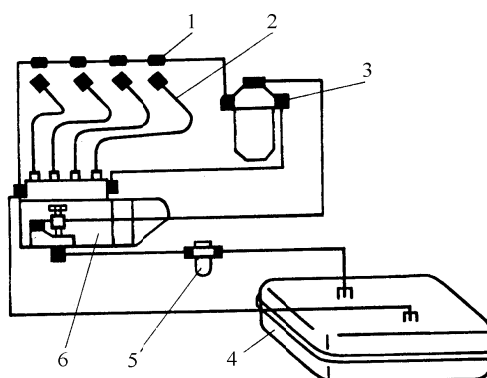
Oil is intake by oil pump through filter screen, and compressed into oil filter. Filtered oil lubricates the crankshaft main bearing, camshaft bearing and rocker arm bearing through engine block main oil gallery. Lubricate the connecting rod bearing through oil gallery in the crankshaft.



Oil filter adopts a totally-closed spin-on type, during operation, if filter element is blocked, the safety valve will automatically open and make oil flow into main oil gallery directly, but at this moment, it has lost its function of filtration, therefore, it is required to timely replace filter elements of oil filter according to "Technical Maintenance" requirements. A pressure regulating valve is set in the oil filter, which can adjust pressure in the main oil gallery, maintaining it within the range of (200~500) kPa.

2.3 Fuel system

Fuel system consists of fuel tank, coarse fuel filter, fuel delivery pump, diesel filter, fuel pump and fuel injector. The diesel enters into fuel delivery pump through coarse fuel filter, and it is delivered by the fuel delivery pump to the diesel filter; after further filtration, it enters into fuel pump, and the high-pressure fuel that comes out of fuel pump is injected into combustion room by the fuel injector; the low-pressure fuel that comes out of fuel pump and the diesel that leaks out of needle valve couple at port of fuel injector flow back to fuel tank, as is shown in Figure 2-2.



1. fuel return pipe; 2. high-pressure fuel pipe; 3. diesel filter; 4. fuel tank; 5. fuel filter; 6. fuel injection pump

Figure 2-2 Fuel Circulation in the Fuel System

The fuel delivery pump is of single-functional piston type, and installed on the outer side of fuel injection pump, it is driven by the eccentric gear on the camshaft of fuel injection pump, what's more, there is a manual fuel pump on the fuel delivery pump, before start-up of diesel engine, loosen the bleeder screw, and unscrew the manual fuel pump handle, tilt it up and down reciprocally to pump fuel and exhaust the air, making the whole fuel pump filled up with fuel. After finishing the air bleeding, the handle should be screw up, in order to avoid fuel leakage.

Diesel filter is used for separating mechanical impurities in the diesel, and reducing wearing of plunger couple and nipple needle valve couple. Blockage or damage of filter element, it is necessary to replace it.

The fuel injection pump is a BQ pump, electronic governor. The fuel injection pump is driven



by fuel injection pump timing gear, through the fuel injection pump camshaft, idler wheel and tappet, making the plunger move reciprocally in the plunger liner. The control mechanism which changes the fuel volume is made up of adjusting pull rod, shifting fork and adjusting arm pressed on the plunger, and the position of pull rod is controlled by the governor, when the pull rod move forward, the fuel supply raises, otherwise, declines.

Before delivery of engine out of factory, the fuel injection pump has been adjusted and lead-sealed by manufacturer; users shall not disassemble it at will. When it is necessary to disassemble or repair, adjusting test should be conducted on test bench for fuel pump.

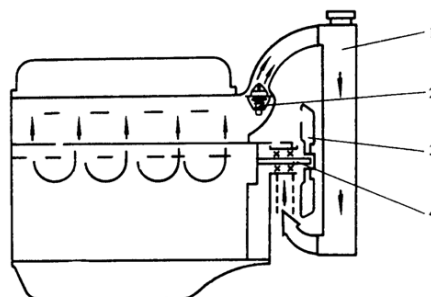
The fuel injector is of P Series, which is compressed up by a compression bolt and a flat clamp, the height of nozzle sticking out of cylinder head bottom surface can be adjusted with a gasket. The fuel injector should be maintained as specified in these instructions, in which, the needle valve couple are ground in pair, when disassembling, they shall not be exchanged, and should be kept clean.

2.4 Cooling system

The cooling system is forced circulation water cooling, as is shown in Figure 2-3.

It includes radiator, water pump, fan, and thermostat and so on. When the temperature of cooling water in engine block is lower than 73°C, the thermostat does not open, and the cooling water is circulating inside the engine (namely small circulation), making the temperature of water in the engine rise rapidly so that the engine reaches thermostability as soon as possible. When the temperature of cooling water reaches 80°C, the thermostat gradually opens, at the same time, the small circulation is closed. Cooling water enters into radiator through thermostat, reenters water pump after cooled by fan, and then enters engine block, fulfilling the big circulation.

This engine adopts centrifugal water pump, and the water pump adopts self-lubricating inner integral ball bearing, so no need to fill in lubricating grease. During use, when the water seal is worn, and there is serious water leakage in the water hole below the water pump body, it is necessary to replace the water seal.



1 radiator 2 thermostat 3 fan 4 water pump

Figure 2-3



2.5 Electric appliance

Electric system includes storage battery, starter, alternator, relay governor, electric lock, preheating start-up switch and ammeter, etc.

The alternator is of JFWZ13 (14V/25A, in-built governor and reserved speed sensor binding post) AC shunt excitation alternator. It is formed by rectifying three-phase alternator and silicon diode, connect the negative electrode to the earth, never connect in the opposite direction; otherwise, the alternator will be damaged.

The starter is a series excitation DC motor (12V/3kW) of type QDJ1408L-P. The once continuous service time of starter shall not be longer than 10s, and the interval between twice start-ups is 2 min, if consecutive 3 times of start-ups all fail, it is necessary to check and troubleshoot. For the overhaul and troubleshooting methods of starter, please refer to "Operation and Maintenance Instructions for Starter".

The storage battery is of type 6Q-140, and voltage is 12V. Before use, the storage battery should be initially charged by filling in battery solution according to the specification. During use of the storage battery, please note that:

1. Frequently check the height of battery solution at least once a week, when the height is lower than (10~15) mm, it is necessary to add distilled water or other purified water, and it is forbidden to use well water or river water.

2. Normally keep unblocked the small air hole in the nut cover over the port of solution, and the outer surface of battery should be kept clean and dry.

3. Normally keep the quantity of electric charge of storage battery not less than 75%. When the storage battery is discharged by up to 50%, and then it's time to charge it. The discharging degree of storage battery can be checked by aerometer or discharging instrument.

4. If any used storage battery will not be used again temporarily, before parking, it should be fully charged, and be recharged once a month after that. In the parking period, do not pour out the battery solution.

3. Installation and Use of Diesel Engine

3.1 Notice for Use of New Diesel Engine

The new diesel engine must be run in before use. Through running-in, ideal fitting will be achieved between the kinematic pair contact surfaces to avoid abnormal wear and damage.

The new diesel engine has received only 1-2 hours of stand run-in before leaving the factory; therefore, the user must let the engine run at rated speed and 50% of rated load for 40-50 hours, and after that the engine can be used normally at full rated speed and full load. It is strictly



prohibited to run the new diesel engine at high speed and high load at the very start, or otherwise the engine will be worn prematurely, and its service life will be shortened, or scuffing of cylinder bore and bearing will occur in severe cases.

3.2 Unsealing of diesel engine

When the packing case of diesel engine is opened, the user should check if there is damage on surface of the diesel engine, and if there is looseness of connecting parts and any other problem, after that, continue with following steps:

- ◆ Wipe the antirust coat and corrosion remover and other exposed parts;
- ◆ Drain the oil seal oil inside the fuel filter and the fuel system parts (it is also allowed to start the engine without draining the oil seal oil in the fuel system, but only when the oil seal oil in the fuel system has been exhausted and normal diesel has been supplied, can the engine run with added load).

Note: The oil seal period of engine is usually one year, any exceeding one year should be checked and necessary complementary measures should be taken on it.

- ◆ Turn the flywheel and spray solvent into air intake pipe, until the oil seal oil in the cylinder is driven out completely.
- ◆ Refill lubricant of appropriate brand into the oil sump as required.
- ◆ Freezing points of special coolant of Weichai Power are -25°C , -35°C , -40°C , please select special coolants with different freezing points according to local ambient temperature, and the principle of selection is that the freezing point should be lower than local minimum air temperature by 10 degrees or so.

3.3 Hoisting of diesel engine

When hoisting, keep horizontal the crankshaft center line of engine, and inclined or unilateral hoisting is forbidden. Hoisting and seating should be slow, see Figure 3-1.

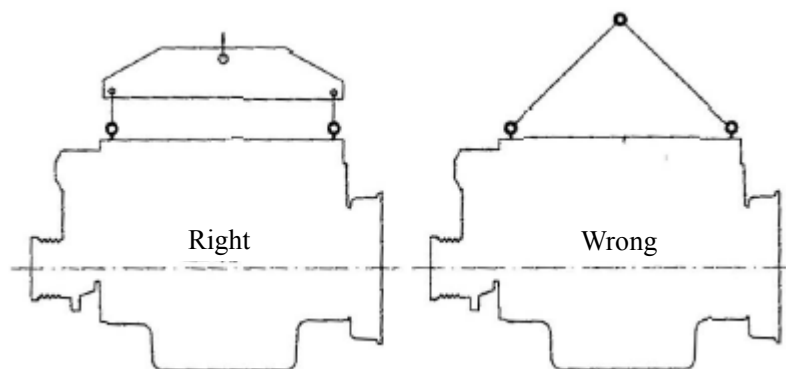


Figure 3-1 Hoisting Diagram of Diesel Engine



3.4 Assembly of diesel engine and notes

The diesel engine output power at the end of flywheel. When matching and assembling, it is necessary to adopt elastic connecting and ensure the crankshaft center line of engine coaxial with the axis of input shaft of alternator, what's more, ensure that the crankshaft will not bear the additional axial force caused by assembling. The coaxiality of crankshaft center line and gearbox input shaft center line should be smaller than 0.2mm, and the end face run-out should be smaller than 0.2mm, adjustment of coaxiality is as shown in Figure 3-2.

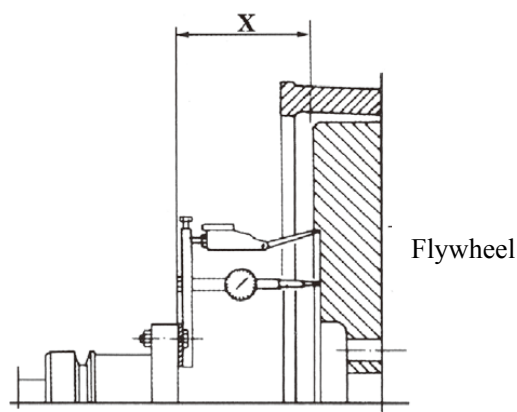


Figure 3-2 Check of coaxiality

During use of the diesel engine, the user should periodically check it as required above, in case of inconformity, timely correct in order to ensure the normal running.

3.5 Installation of external system of diesel engine

1) Air exhaust pipe of engine should be connected outdoor, avoid excessive bending of exhaust pipeline of diesel engine, expansion joints should be installed in the middle of the pipeline, and support should be added to the pipeline; inner diameter of exhaust pipeline should not be smaller than 50mm, and exhaust back pressure should not be larger than 5kPa.

2) The exhaust pipe outlet located outdoor should be installed with a rain cover, and in order to drain the condensed water in the air exhaust pipe smoothly, a water drain valve can be installed at the lowest position of air exhaust pipe.

3) The air intake pipe inlet located outdoor should be installed with a rain cover to prevent rainwater from entering the exhaust system.

4) Capacity of the fuel tank should satisfy the requirement for 8 hours of working under rated load, and the diameter of fuel pipeline should not be smaller than 5.5mm.

3.6 Prestart Preparations for Diesel Engine

- ◆ Check the coolant level



Check the coolant level, if coolant is insufficient, open the liquid filling port cover and add coolant. Avoid by all means adding large volume of coolants into the engine when it is in a hot state. If in abnormal conditions there is no coolant, it is allowed to fill in distilled water at not too low temperature, and fill in coolant through the filling port until the coolant overflows. Start the engine, and during the running of engine, continue to add coolants to top up the tank until the liquid level is stable, finally cover the filling port with its cover.

◆ Check the fuel level

Turn on the switch of power supply, and check the fuel level from fuel gauge or check the fuel tank.

◆ Check oil level of diesel engine

The oil level should be between the upper and lower scale marks, if necessary, add oil through the oil filling port.

◆ Check if connection of all kinds of accessories of engine is reliable, and eliminate abnormal phenomena. Check if wiring of start-up system is in normal condition, and if the storage battery is fully charged.

3.7 Start of diesel engine

Before start, check if there is pressure in hand operated fuel supply pump, and if the fuel injection nozzle gives off “coo” sound when rotating the diesel engine; if there is neither pressure nor sound, the air in the fuel passage should be exhausted.

The starting motor should not work continuously for more than 10s. If the first start failed, the second start should be made 2 min later; if the start failed for more than three successive times, identify and eliminate the fault before trying to start again.

3.8 Running of Diesel Engine

1) After start-up of diesel engine, make the engine run at idle speed for 3min, do not enter into running with part of load until the oil pressure is normal, and only when water temperature is higher than 60°C, it is allowed to enter into full-load running. When the diesel engine is running, constantly pay attention to the readings of all kinds of meters, especially oil pressure. Load and speed should be increased gradually, try to avoid sudden increase and decrease of load.

2) During the 60h run-in period, it is suitable for the diesel engine to work under medium load and below.

3) It is unsuitable for the vehicle to run at idle speed, otherwise, oil pumping and other faults will easily occur.

4) In normal working condition, the diesel engine is allowed to continuously run with rated



power at rated speed, but if running with 110% of rated power, only 1 hour of working time is allowed in every 12 hours. After unloading, the diesel engine should stop after running for (1~2) min at idle speed.

5) The parameters and check points that should be paid attention to in use:

Lubricant main gallery pressure: (200~500)kPa; and oil pressure at idle speed should not be lower than 98kPa;

Oil temperature in main gallery $\leq 115^{\circ}\text{C}$

Temperature at coolant outlet: (75~95) $^{\circ}\text{C}$

Rear exhaust air temperature of turbine $\leq 500^{\circ}\text{C}$

Check the exhaust air color in order to identify the working quality and service load of fuel injector, if there is heavy black smoke or white smoke, stop the engine and check.

Note to check if there is water leakage, air leakage and oil leakage of diesel engine, if there is, stop the engine and troubleshoot.

6) In order to avoid damage to diesel engine, when the engine is working, neither the cable leading to pressure regulator of engine nor the cable leading to positive electrode of storage battery shall be removed. Different from DC generator, AC alternator is strictly not allowed to be temporarily connected to earth for power resource check.

3.9 Stop of diesel engine

Before the diesel engine can be stopped, it should be unloaded and decelerated, and should idle for a few minutes. In case of galloping and other failure, you can block the air filter inlet to force the diesel engine to stop.

After the diesel engine is stopped, the electricity key should be disconnected to prevent the battery current from flowing back into the excitation ring of silicon rectification dynamo to avoid battery discharging.

When the atmospheric temperature is below 0°C , if the engine should be stopped for a long time, the cooling water should be drained off to prevent the engine block from being frost cracked; if antifreezing fluid has been added to the cooling water, and then there is no need to drain water.

3.10 Power Definition and Working Conditions of the Diesel Engine

3.10.1 Power definition

✧ Continuous Power COP

In unlimited annual running time of diesel engine, the maximum power acquired when the engine is running continuously under constant load. ISO standard power

✧ Normal Power PRP



In unlimited annual running time of diesel engine, the maximum power acquired when the engine is running continuously under variable load. ISO standard power which can overload by 10%

✧ **Standby Power ESP**

Maximum power in some variable power series with annual running time of diesel engine up to 200h. ISO standard power with limited fuel volume

3.10.2 Running Conditions and Applications of Power

Running conditions and applications of different powers of diesel engine are as shown in Table 3-1.



Power Classification	Running Condition	Application
Continuous Power COP	1. Unlimited annual running time; 2. Running under constant 100% load; 3. Incapable of overload running.	Can be used for running under the condition of high-temperature and plateau.
Normal Power PRP	1. Unlimited annual running time; 2. In every continuous period of 250h, average load rate shall not exceed 70%; 3. Annual running time under 100% load shall not exceed 500h; 4. Running time within 12h under overload by 10% can be 1h, and annual accumulative total running time does not exceed 25h.	Used for the condition that power output has been appointed, for example, such as utility power reduction. The gen-set can be synchronized to the public utility power grid.
Standby Power ESP	1、 annual running time does not exceed 200h, including annual running time under 100% load below 25h; 2、 in every running cycle of 24h, average load rate shall not exceed 80%; 3、 incapable of overload running. 4、 For start-up of diesel engine, there is no process of engine heating, it takes 10s to finish the acceleration from start-up to rated speed. When ambient temperature is below 5°C, for naturally aspirated diesel engine, preheating facility should be added to ensure the outlet water temperature of diesel engine is above 30°C; When ambient temperature is above 5°C, no need for preheating facility. For supercharged diesel engine, when ambient temperature is below 10°C, preheating facility should be added to ensure the outlet water temperature of diesel engine is above 30°C; When ambient temperature is above 10°C, no need for preheating facility.	Provide emergency power supply during power supply outage.

4. Maintenance of Diesel Engine

4.1 Fuel, Lubricant, Coolant and Auxiliary Materials used for Diesel Engine

◆ Fuel

For summer: 0# diesel (GB252).

For winter: usually use -10# light diesel (GB252). But when barometric temperature is lower than -15°C, use -20# diesel, and when outdoor temperature is lower than -30°C, use -35# diesel.



Note: all the fuel used must comply with specifications in Table D1 of Appendix D in National Standard GB 20891-2007.

◆ Lubricant

First-time oil-filling volume for the engine is 9L; however, the capacity of lubricant is based on the mark of dipstick.

Non-road Tier 2 series diesel engines use oil of Grade CF-4, and to choose the viscosity of special oil according to temperature; please refer to Table 4-1.

Note:

- 1) Before start-up of diesel engine, first check the oil level in the oil sump.
- 2) Do not check the oil level when the diesel engine is running..
- 3) The special oil is not allowed to be mixed with any other kind of oil of different quality.

Table 4-1 Corresponding Table of Viscosity and Ambient Temperature

SAE Viscosity Grade	Applicable Ambient Temperature (°C)
0W-20	-35-20
5W-30	-30-30
10W-30	-25-30
15W-40	-20-40
20W-50	-15-45

◆ Coolant

The diesel engine cooling system must adopt pure cooling liquid. The cooling liquid can be used to prevent freezing under cold weather and to prevent boiling under high temperature. It is applicable to vehicles running under various temperatures. Furthermore, the cooling liquid contains rust-inhibiting and anticorrosion additives, which offer special protection to the water tank and generator cooling chamber, and avoid cylinder sleeve cavitation and cooling system corrosion.

The freezing points of Weichai Power dedicated cooling liquids shall be -25°C, -35°C, -40°C, etc. Please use Weichai dedicated cooling liquids of appropriate freezing points according to local ambient temperature. The freezing point should be approximately 10°C lower than the local temperature.

Note:

- 1) The coolant must be checked periodically, and to prevent damage caused by corrosion, it should be replaced in time according to the situation.
- 2) It is forbidden to use water or cooling liquid of bad quality as coolant for engine.



4.2 Daily Maintenance of Diesel Engine

Every day, before starting the diesel engine, check the external parts of engine, as following:

- Check cooling liquid level, oil level and fuel level;
- Check if there is leakage in fuel system, cooling system, lubrication system or on junction surface.
- Check if connection and fastening of external parts and accessories are in good condition;
- After start-up of engine,

◆ Check cooling liquid level

Observe the cooling liquid level through glass sight hole, if the coolant is not enough, open the filling port and add the coolant.

Note: When opening the filling port cover, the air exhaust button must be pressed down first in avoid of hurt by coolant when the diesel engine is in hot state.

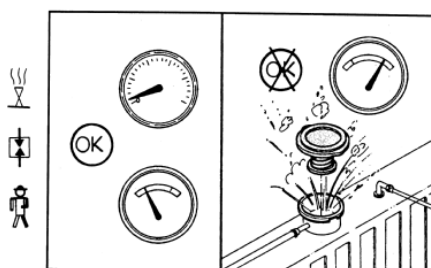


Figure 4-1 Explanation graph of notes for water filling port cover when filling in water

◆ Check the oil level.

When the oil level is below the lower scale mark of dipstick or above upper scale mark of dipstick, it is not allowed to start the diesel engine.

If check the oil level after shutdown of diesel engine, at least wait for 5min to make the oil has sufficient time to flow back to oil sump.

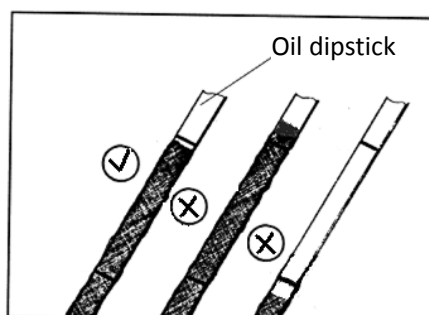


Figure 4-2

◆ Check fuel level



◆ **Check for “Three Leakages”**

No water leakage, air leakage or oil leakage on the vehicle.

◆ **Check the belts**

Belts are automatically tensioned by belt tensioner, and users check the tightness of belts through pressing the belts by hand.

◆ **Check if the sound of engine is normal.**

◆ **Check if speed and vibration of engine is normal.**

◆ **Lubricant Replacement of Diesel Engine**

Unscrew the oil drain screw plug at bottom of oil sump, drain up the oil and tighten the oil drain screw plug; Open the oil filling port cover, refill oil through the oil filling port, observe the scale of dipstick until it meets requirements, and then tighten the oil filling port cover.

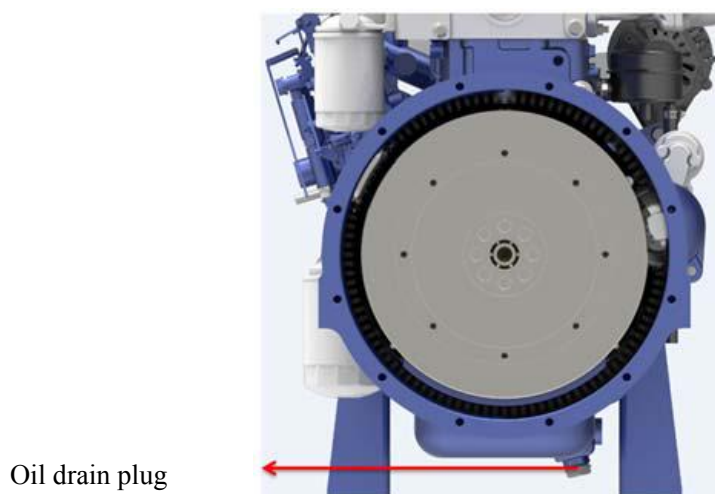


Figure 4-3

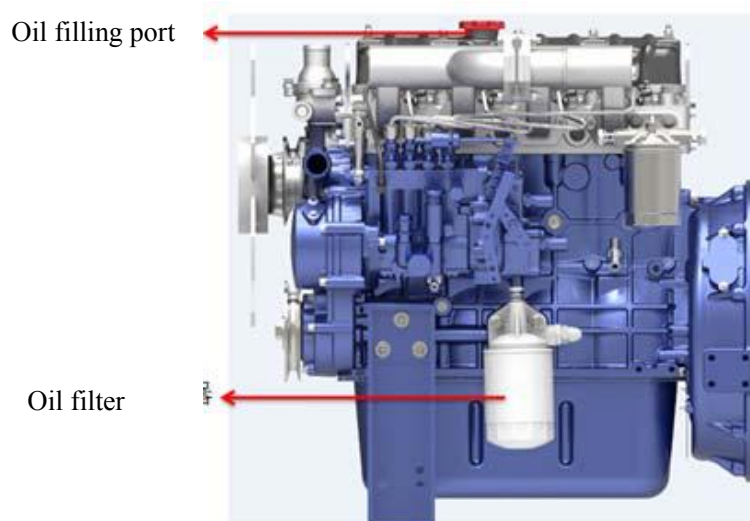


Figure 4-4



Replacement of Filter Elements of Oil Cooling and Filtration Module

- 1) Remove the old oil filter;
- 2) Fill up the new filter with clean oil;
- 3) Before assembling the new oil filter, apply oil on the sealing gasket;
- 4) After the gasket contact with the base, tighten again by 3/4 to 1 round, and make it sealed;
- 5) Start the diesel engine and check if there is oil leakage.

◆ Replacement of Fuel Filter Element

- 1) Disassemble the old fuel filter elements; If the water collecting vessel installed on the coarse filter can be used again, please remove the water collecting vessel;
- 2) Lubricate the seal;
- 3) Screw up the fuel filter by hand until the seal connect with the connector;
- 4) Continue to screw the filter by hand until the filter is securely installed (by about 3/4 round);
- 5) Exhaust the air until no air bubble appears;
- 6) Conduct leakage test.

◆ Adjustment of valve clearance

Check and adjust the intake and exhaust valve clearance in the following steps.

1) When the diesel engine is at cold state, turn the crankshaft clockwise (in the same direction where the diesel engine rotates) until the pistons of Cylinder 1 and Cylinder 4 reach their TDCs respectively. At this moment, the OT scale mark of crank pulley aligns with the pointer above it.

2) Disassemble the valve rocker arm cover on the cylinder head, and judge if Cylinder 1 or Cylinder 4 is in its compression stroke (There are clearances between air intake and exhaust pipes and rocker arm of cylinders which are in their compression strokes),

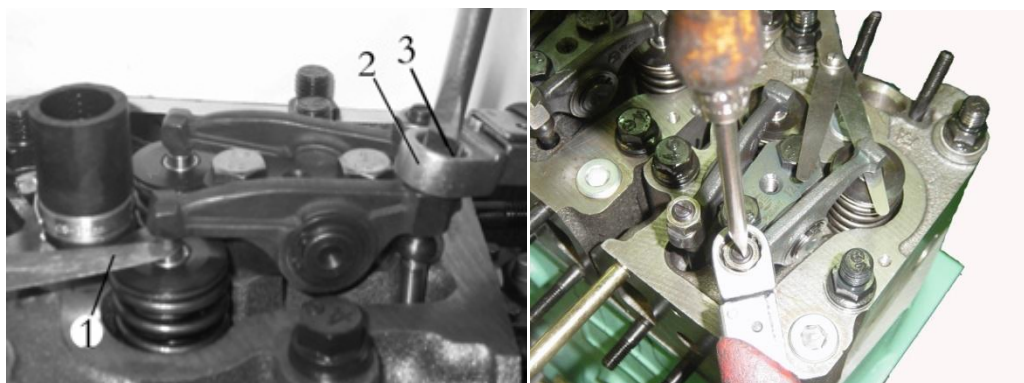


Figure 4-5 Adjustment of valve clearance

3) As is shown in Figure 4-5, use a feeler gauge to check the clearance between upper plane of valve and rocker arm of valve. If the clearance is overlarge or oversmall, it is possible to meet the clearance requirements by adjusting the adjusting bolts on the rocker arm. In cold state,



clearance of the air intake valve is required to be 0.35mm, and clearance of the air exhaust valve 0.35mm.

4) After check of Cylinder 1 or Cylinder 4, turn the crankshaft clockwise again by 360° so that Cylinder 1 or Cylinder 4 is at TDC of its working stroke, and then check and adjust the rest valves.

Table 4-2 Status of all cylinders in compression stroke

	First cylinder	Second cylinder	Third cylinder	Fourth cylinder
First cylinder at compression stroke	Intake and exhaust valves	Intake valve	Exhaust valve	Nonadjustable
Fourth cylinder at compression stroke	Nonadjustable	Exhaust valve	Intake valve	Intake and exhaust valves

4.3 Routine maintenance of diesel engine

In addition to routine maintenance, the regular maintenance should also be performed. The inspection items involved in regular maintenance are as shown in Table 4-3:

Table 4-3 Maintenance Standards for Diesel Engine

Maintenance item	Initial inspection	P	WD1	WD2	WD3	WD4
Replacing diesel engine oil	•	•	•	•	•	•
Water pump	•		•	•	•	•
Replacing oil filter	•	Each time when replacing the engine oil				
Checking and adjusting the valve clearance	•		•	•	•	•
Checking opening pressure of fuel injection nozzle					•	•
Replacing fuel filter			•	•	•	•
Cleaning fuel pump strainer			•	•	•	•
Maintenance item	Initial inspection	P	WD1	WD2	WD3	WD4
Checking cooling liquid volume and refilling, if necessary	•	•	•	•	•	•



Replacing cooling liquid	Every 24 months					
Fastening cooling pipe clamp	•					
Fastening admitting pipe, hose and flanged fitting	•		•	•	•	•
Checking air filter maintenance indicator light			•	•	•	•
Cleaning dust-collecting cup of air filter (excluding automatic dust-discharging type)		•	•	•	•	•
Cleaning air filter main element	When the indicator light is on					
Cleaning air filter security element	When the indicator light is on					
Replacing air filter main element	Refer to Use Instructions					
Replacing air filter security element	After the main filter element has been cleaned for five times					
Checking and tightening the V-belt	•	•	•	•	•	•
Checking fuel injection pump at special workshop						•
Adjusting the idle speed	•					
Note 1: If cracks or other defects affecting the normal use are found on accessory driving belt surfaces, such belts must be replaced.						
Note 2: Any accessories found abnormal must be replaced immediately.						

Special tips: If the user fails to maintain the diesel engine as per the maintenance schedule specified herein, or no maintenance record can be found at the service station, then any subsequent quality warranty shall become invalid.

4.4 Maintenance Cycle of Diesel Engine

Maintenance specifications for diesel engine are as shown in Table 4-4.

Table 4-4 Maintenance Cycle



Initial inspection	After (30~50) hours' running of diesel engine
Routine check (P)	In every 200 hours' running of diesel engine
First level maintenance (WD1)	In every 500 hours' running of diesel engine
Second level maintenance (WD2)	In every 1000 hours' running of diesel engine
Third level maintenance (WD3)	In every 2000 hours' running of diesel engine
Fourth level maintenance (WD4)	In every 4000 hours' running of diesel engine
Instructions: Above maintenance cycle is calculated based on 1500 running hours of diesel engine per year, if annual running time of diesel engine is less than 500 hours, then its maintenance cycle is 0.5 times of above cycle. For diesel engine whose annual running time exceeds 1500 hours, its maintenance cycle will be 1.5 times of that of above cycle.	

4.5 Maintenance for Long-Term Storage of Diesel Engine

Cleaning of diesel engine;

Protection work:

1) If the diesel engine will not be used for a long time, after shutdown of engine, it is required to drain the oil while it is hot.

2) Open the water drain valve, drain the cooling water in water jacket of engine block and water pump shell.

3) Drain the diesel in the fuel tank.

4) Remove the dust on the air filter elements (Paper air filter). Oil bath type air filter elements should be cleaned with diesel or kerosene.

5) Clean the oil sump and oil strainer.

6) Dismantle the air intake pipe, refill 300g of filtered 20# dehydrated oil (namely heat the oil to 110°C~120°C, until all foam disappears), turn the crankshaft so that the oil is evenly attached to the surface of valve, cylinder liner and piston and other parts, and connect the air intake pipe in place.

7) It is required to wipe out the stain, water and dust on external parts of engine, and also apply anti-rusting oil to unpainted parts (add butter to dehydrated oil, after dissolved, it is formed by mixing them evenly). Oil shall not be applied to rubber products or plastic products.

8) Use oiled paper to pack and seal the air filter and air exhaust pipe orifice, in avoid of intrusion of dust or dirt.

9) The diesel engine should be placed indoor where is well ventilated, dry and clean, and it is forbidden to place it where there is corrosive chemicals, besides, pay attention to preventing the



engine from damp (especially electric system), with above oil sealing method, it can be sealed and stored for three months, when the period expires, repeat above oil sealing method.

5 Common faults and solutions

Whenever the diesel engine is faulty, the causes should be identified immediately and removed to avoid any serious accidents. When judging faults of engine, must be careful; When troubleshooting, it is required to comply with certain operational methods, or else, new faults might be caused.

Some inspection and adjustment are involved in the troubleshooting method, as stated in Chapter IV herein, for the user's reference.

5.1 Start-Up Difficulties of Engine

Failure causes and features	Solutions
1. There is no fuel in the fuel tank or switch of the fuel tank is not turned on.	1. Fill up the fuel tank, and turn on the switch.
2. Blockage of fuel pipeline or filter.	2. Remove the oil pipe and filter, and clean or replace the filter elements.
3. There is air in the fuel system.	3. Eliminate air in the fuel system, and tighten up the oil pipe connector.
4. Fault of fuel injection pump or wrong fuel supply timing.	4. Check the fuel delivery pump and fuel injection pump, and adjust fuel supply advance angle.
5. Fuel injection failure or bad atomization of fuel injector	5. Clean or grind the fuel injector pairs, and adjust fuel injection pressure.
6. Overlow air temperature, diesel engine is too cold.	6. Heat the cooling water, and adopt preheating start-up.
7. Insufficient compression pressure of cylinder	7. See below.
8. The starter does not rotate or lacks power.	8. See below.

5.2 Insufficient power of diesel engine

Failure causes and features	Solutions



1. Cylinder compression pressure is inadequate.	1. See below.
2. Diesel is of poor quality or contains water.	2. Use specified diesel; Clean the oil tank, and replace diesel.
3. Air filter is blocked.	3. Remove the dust from the filter element, and replace the filter element, if necessary.
4. Muffler is blocked.	4. Eliminate carbon deposit or sundries from the muffler.
5. There is air in the fuel system piping and components.	5. Exhaust all air, and tighten the fuel line joints to avoid air leakage.
6. There is error in valve timing.	7. Check the gear mark, valve clearance and camshaft.
7. Fuel supply advance angle is wrong.	7. Check the gear mark, and adjust the fuel supply advance angle.
8. Injection pressure of fuel injector is inadequate, and fuel atomization is poor.	8. Adjust the injection pressure.
9. Fuel supply to various cylinders is not non-uniform.	9. Adjust fuel supply uniformity of fuel injection pump.
10. The rated speed cannot be reached.	10. Adjust position of speed control lever.

5.3 Compression pressure of cylinder is insufficient.

Failure causes and features	Solutions
1. Valve clearance is too small or is zero.	1. Adjust the valve clearance
2. Valve and valve seat have carbon deposit, are worn or poorly sealed.	2. Eliminate carbon deposit and grind valve and valve seat, and mill and grind the valve seat, if necessary.
3. Piston ring is worn, or has inadequate elasticity.	3. Replace the piston ring.
4. Piston ring is glued and jammed by carbon deposit.	4. Clean it in kerosene.
5. Cylinder sleeve and piston are worn and their distance is too large.	5. Replace cylinder sleeve and piston, or bore the cylinder and use enlarged piston.



6. Poor sealing of cylinder head gasket.	6. Tighten cylinder head bolts, or replace cylinder head gasket.
7. Fuel injector hole leaks air.	7. Check copper gasket, and reinstall the fuel injector.
8. Valve spring breaks off.	8. Replace valve spring.
9. Valve and valve guide are seized and jammed.	9. Clean it in kerosene; replace it if it is worn or deformed.

5.4 Sudden Shutdown of Diesel Engine

Failure causes and features	Solutions
1. There is no diesel in the tank.	1. Refill the fuel tank.
2. There is air and water in the fuel system.	2. Remove the air in the diesel system, and drain off water at bottom of fuel tank, and replace fuel filter element.
3. Fuel filter is blocked.	3. Clean fuel filter or replace filter element.
4. Air filter is blocked.	4. Replace filter elements.
5. Piston is seized in cylinder.	5. Overhaul and replace piston and cylinder sleeve.

5.5 Sharp Increase of Diesel Engine Speed (galloping)

Failure causes and features	Solutions
1. Speed governor does not work.	1. Stop the engine immediately, and remove fuel injection pump or speed governor, and overhaul the speed governor.
2. Fuel injection pump rod is jammed.	2. Stop the engine immediately, and overhaul the fuel injection pump.
3. Pump rod comes off.	3. Stop the engine immediately for inspection, and reinstall the pump rod.



5.6 Sound of knock Comes from Diesel Engine

Failure causes and features	Solutions
1. Rough explosion of fuel. There is ringing rat-tat in the cylinder. 2. Fuel burns slowly, and there is "back fire" in exhaust pipe. 3. Clearance between piston and cylinder liner increases, making dumb noise of knock which sometimes sounds like beating of shovel. 4. Clearance between crankshaft and crankshaft main bearing is increased, giving off periodic grave clash. 5. Clearance between crankshaft rod journal and bearing is increased, giving off blunt clash. 6. Clearance between piston pin and connecting rod bush is too large. Making sound of "Dang dang", strong and sharp. 7. Valve clearance is overlarge, giving off "da, da" sound. 8. Air valve impacts with piston head, giving off ringing clash.	1. Adjust fuel supply advance angle. 2. Adjust fuel supply advance angle. 3. If the sound weakens after cylinder stops for 3~5 seconds, it is proved. Stop the engine and repair or replace piston and cylinder liner. 4. Listen to the sound near main bearing, after shutdown of cylinder, little change takes place, while working with full load, the sound gets more significant. Stop the engine and repair or replace the main bearing shell or thrust plate. 5. Listen and check near main bearing seat. And check one by one according to cylinder number at low speed. Stop the engine for overhaul. Replace the main bearing shell. 6. Listen to the sound on the upper part of left side of engine block, when speed and load rise, the sound gets stronger and more powerful, after stopping the cylinder, the sound gets weak. Stop the engine for overhaul, and replace connecting rod bushing. 7. There is continuous sound on one side of cylinder close to valve, and it doesn't change because of cylinder shutdown. Stop the engine, and adjust valve clearances. 8. Listen to the sound close to the fuel injector, and check if there is vibration, and check the valve clearance and valve timing.



5.7 Black smoke emits from air exhaust pipe.

Failure causes and features	Solutions
1. Diesel engine works overload, and fuel burns insufficiently. 2. Fuel injection pump flow is overlarge or non-uniform. 3. Injection pressure of fuel injector is excessively low, and fuel atomization is poor. 4. Fuel injection is too late, and there is fuel burning in exhaust pipe. 5. Air filter is blocked, and air admission is unsmooth. 6. Diesel oil used is of heavy type or of poor quality.	1. Reduce load. 2. Adjust fuel injection pump and speed governor. 3. Adjust the injection pressure. 4. Adjust fuel supply advance angle. 5. Remove the dust from the filter element or replace it. 6. Use the diesel type specified herein.

5.8 Temperature of outlet water of diesel engine is too high.

Failure causes and features	Solutions
1. Water pump fan belt is too loose, and water flow is too small. 2. Diesel engine works under overload condition for too long. 3. Insufficient coolant. 4. Water pump capacity is inadequate, resulting in inadequate circulating water volume. 5. Water pump impeller is damaged. 6. Cooling system is blocked. 7. Thermostat does not work. 8. Water temperature gauge does not work. 9. Engine is poorly lubricated, giving rise to high oil temperature.	1. Adjust the pulley tension or replace the belt. 2. Reduce load. 3. Fill up with coolant. 4. Check clearance between impeller and housing, and replace any defective impeller. 5. Replace water pump impeller. 6. Clean the cooling system. 7. Check the thermostat, and replace it, if necessary. 8. Replace water temperature gauge. 9. Check lubricating system or clean lubricant passage way.



5.9 Overflow oil pressure

Failure causes and features	Solutions
1. There is inadequate oil in the oil pan. 2. Oil pressure alarm does not work. 3. Oil gallery is blocked. 4. Oil pump suction filter screen is blocked. 5. Oil filter is blocked, and safety valve does not work. 6. Main bearing and connecting rod bearing of diesel engine are worn and clearance is increased. 7. Diesel engine is overheated, and oil temperature is high, and oil becomes diluted. 8. Clearance between oil pump gear and housing and backlash is overlarge.	1. Measure the oil level with oil level indicator. Refill oil to upper scale mark. 2. Replace oil pressure alarm. 3. Clean oil passage, and purge it with compressed air. 4. Dismantle the dust screen, and clean it with diesel. 5. Clean filter or replace filter element, and adjust the safety valve as per specification. 6. Overhaul or replace main bearing and connecting rod bearing. 7. Reduce load, replace oil and reduce oil temperature. 8. Replace gear or housing.

5.10 Excessive consumption of oil

Failure causes and features	Solutions
1. Oil ring, once glued by carbon deposit or worn, will increase in clearance, unable to scrape oil any more. 2. Oil ring spill pore is blocked by carbon deposit. 3. The oil is overfilled, and the oil is splashed excessively, part of which entering into the combustion chamber, and causing the exhaust pipe to give off blue smoke. 4. Oil connection or gasket is leaky.	1. Clean oil ring, and replace it, if it is excessively worn. 2. Eliminate the carbon deposit in spill pore. 3. Drain part of oil, limiting the oil level to below upper scale mark of oil level indicator. 4. Tighten oil passage joints, and replace gasket.



5.11 Oil dilution and aging

Failure causes and features	Solutions
1. Oil ring, once glued by carbon deposit or worn, will cause gas blowby or causing diesel to leak into the oil pan. 2. Cylinder head gasket is leaky. 3. Cylinder head has cracks or shrinkage porosity, or is leaky.	1. Clean piston ring, and replace it if necessary. 2. Check or replace cylinder head gasket. 3. Replace cylinder head.

5.12 Common Faults in Circuit

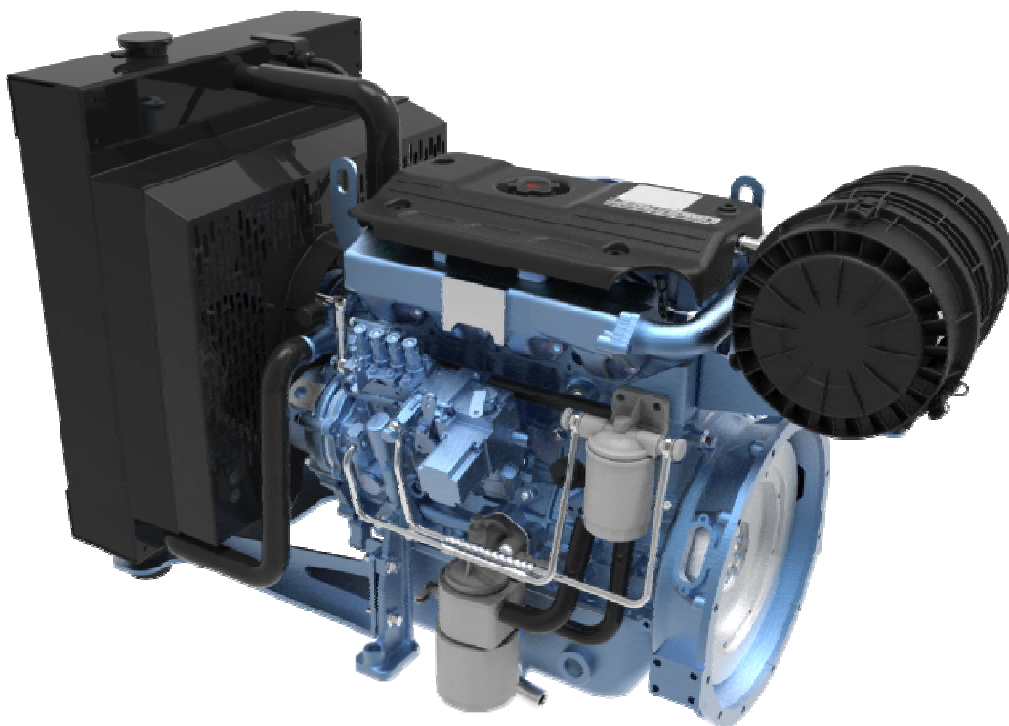
Failure causes and features	Solutions
1. Dynamo does not charge or charges at excessively weak current. (1) Loose wiring joints of generator or storage battery (2) Slipping of belt (3) Generator failure 2. Dynamo current is too strong or dynamo heats up (1) Short-circuit between binding posts of armature rotor and magnetic field rotor of generator (2) Voltage adjuster failure 3. Voltage regulator resistor is burnt out (1) The positive and negative poles of storage battery are wired in an opposite way. (2) The cut-off device fails, and the current flow reversely when the diesel engine is running at low speed. 4. The starter doesn't rotate. (1) Fuse blowout (2) Loose wiring joints (3) Storage battery undercharged	(1) Check all the wiring joints, and do rust protection and insulation. (2) Adjust the tensioning of pulley. (3) Check the generator. (1) Check or replace them. (2) Check or replace them. (1) Correct the way of wiring. (2) Overhaul or replace it. (1) Replace the fuse and check the wiring to short-circuit. (2) Remove the dirt, and screw up the joints. (3) Overhaul and charge it.



(4) Poor contact of carbon brush	(4) Clean and grind with very fine sandpaper.
(5) Internal short-circuit of starter	(5) Dismantle, check and repair
5. Starter can rotate, but produces underpower	
(1) Poor contact of carbon brush	(1) Clean and grind with very fine sandpaper.
(2) Poor contact of joints or switch	(2) Screw up all joints, remove dirt.
(3) Storage battery undercharged	(3) Overhaul and charge it.



Operation Manual for 4M06 Industrial Power Diesel Engine



Special Tips

- Before operation of the engine, the operating personnel must carefully read the operation and maintenance manual, and strictly comply with the operation and maintenance standards specified in the manual.
- Before delivery, the engine has passed the before-delivery test in our company according to strict standards and the user shall not remove the lead seal of high-pressure fuel pump at will, or increase the power of engine. Otherwise, our company will not perform the “Three Guarantees” commitment, please note this;
- There are strict torque requirements and times of use for main bearing bolts and connecting rod bolts and other kinds of bolts of the diesel engine, the user shall not loosen or disassemble them at will. The connecting rod bolts are disposable, so repetitive use is not allowed;
- Brands of oil or fuel used for this engine must comply with the regulations in the maintenance manual, and the oil or fuel should be filtered by special clean filter, and the fuel should be used after 72 hours of precipitation. Before every time of start-up, it is required to check if the filling volume of coolant or oil meets their respective requirements.
- It is forbidden to run the engine without air filter, in order to prevent unfiltered air from entering into the cylinder;
- When using a new engine, the user should conduct a pilot run for 50 hours;
- After cold-start, speed up the engine gradually instead of making it run at high speed in a sudden or at idle speed for a long time (idle speed time shall not exceed 3min); after running with heavy load, it is inappropriate to stop the engine immediately (except for special cases), and it is necessary to stop the engine after running at low speed for 5min-10min;
- It is required to check the coolant periodically, and it is forbidden to use water or low-quality coolant as coolant for the engine. After shutdown of engine, if possibly the temperature in the running environment is lower than 0°C, and anti-froze additive has not been added into the coolant, it is required to drain the coolant in the water tank and diesel engine.
- Overhaul of all the parts in electric system must be conducted by professional electrical technicians;
- The diesel engine is treated with oil upon delivery to prevent rusting. In general, the storage life of the diesel engine before unpacking is one year; therefore, it is necessary to check and take necessary remedial measures for those which have been stored for over 1 year.
- For the non-road Stage II diesel engine, special diesel for non-road Stage II should be used, otherwise, Weichai will bear no responsibility for excessive emission and other problems of diesel engine caused by filling fuel not as required.
- Please only send the engine to service stations designated by Weichai for overhauling and maintenance. Only spare parts designated by Weichai can be used for maintenance, or otherwise Weichai shall not be held responsible for any damages to diesel engine caused by not using the spare parts designated by Weichai.



Preface

This series of diesel engine is of high-speed diesel engine developed by Weichai Power Co., Ltd. independently (and is manufactured by Weichai Power (Yangzhou) Diesel Engine Co., Ltd.). This series of diesel engines have a compact structure, reliable use, and excellent power, economy, emission level and other technical indicators, with the characteristics of swift start-up, easy operation and convenient maintenance.

This manual mainly includes notes for use, maintenance methods, common check and adjustment, and diagnosis and troubleshooting for common faults of 4M06 Non-road Stage II Stationary Industrial Power Diesel Engine, and other contents. During compilation, we strive to make it systematic and universal, simple and practical. It is necessary to point out that to judge faults of diesel engine is a job, which calls for carefulness and a certain amount of knowledge, before figuring out the reason, usually do not disassemble the engine at will, otherwise, the fault will not be eliminated, more serious fault might be caused by incorrect assembly after disassembly instead. Especially for repair or check of electric system and other key parts, special instruments and devices should be used, so as an inexperienced and unconditioned user, please do not disassemble or adjust them at will.

As the continuous increase of variant products of this series diesel engine, not every alternation will be informed. The users can acquire latest product information through the website below: <http://www.weichai.com>. The after-sales service for this product is uniformly authorized to and carried out by Weichai Power Co., Ltd.

Welcome the users to give suggestions and opinions for further improvement of the products.



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Chapter I Instructions for Use of Diesel Engine

1.1 Outside View of Diesel Engine

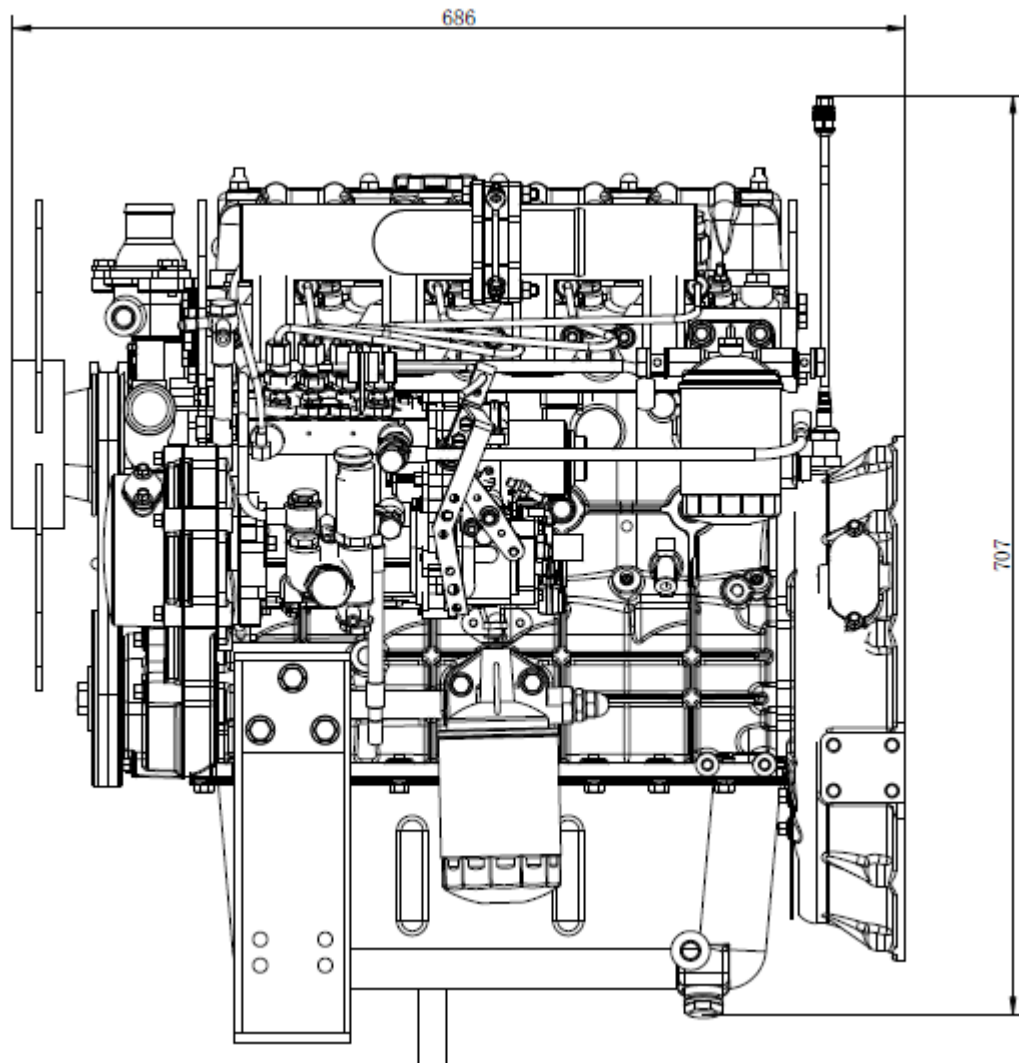


Figure 1-1 Air Intake Side of 4M06 Non-road Stage II Stationary Industrial Power Diesel Engine



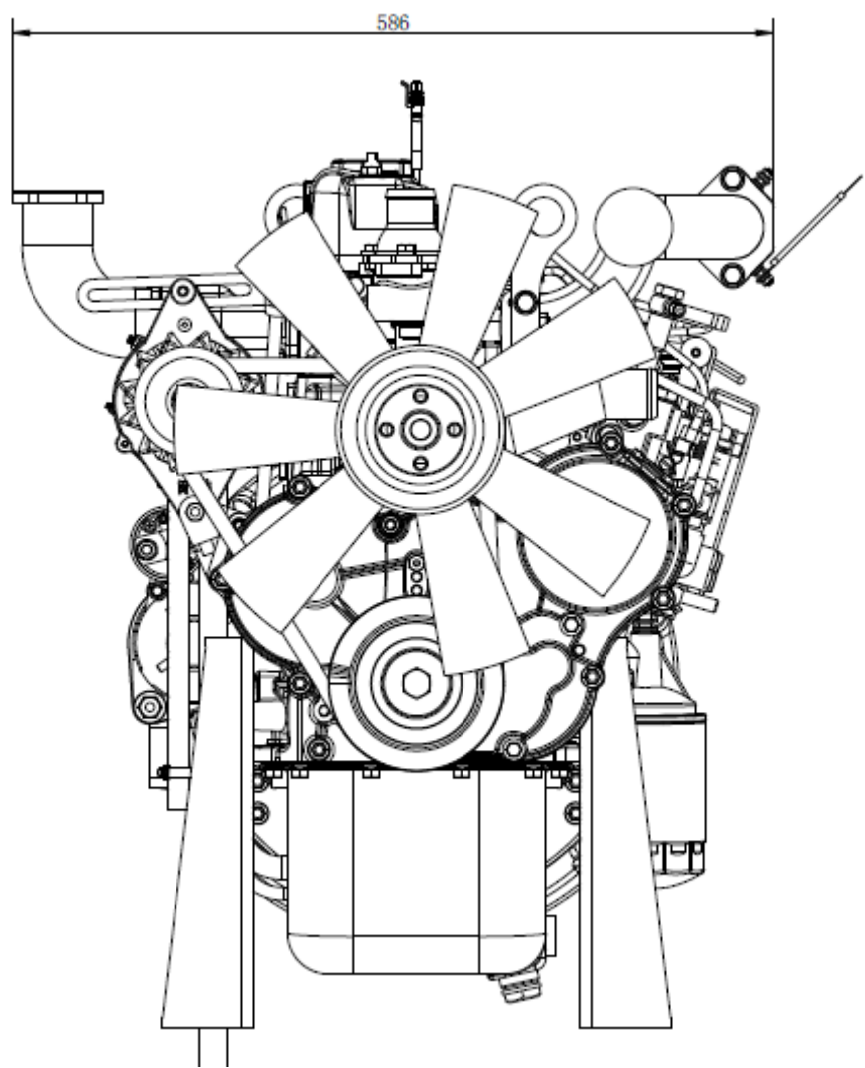


Figure 1-2 TheFree End of 4M06 Non-road Stage IIStationary Industrial Power Diesel Engine

1.2 Definition of Engine Type

4	M	06	G	55	/	5	
							Hertz Code
							Oblique Line
							Power Code
							Usage code
							Displacement per Cylinder
							Product Code for Baudouin
							Cylinder Number



Usage code: G—Land Power Generation

Power Code: for 50Hz correspond standby power(kVA) of generating set.

Power Code: for 60Hz correspond prime unlimited time power (kW) of generating set.

Hertz Code: 5—50Hz, 6—60Hz

1.3 Main technical parameters of diesel engines

For model, power, speed, identification number, weight and other information of the engines, please refer to nameplates of engines!

Other performance parameters are given in the following table:

Item	Unit	Type
Engine type	—	inline, water-cooled, four-stroke, direct injection type
Number of cylinders	—	4
Bore × stroke	mm× mm	89×92
Displacement	L	2.3
Power range	kW	23~58
Minimum fuel consumption rate	g/(kW·h)	205
Oil/fuel consumption ratio	%	≤0.4
Crankshaft rotation direction (see from the free end)	—	Clockwise
Starting method	—	Electric starting
Allowable long-term tilt angle	°	7

1.4 Notice for Use of New Diesel Engine

a. Within the first 60 h (or 3,000 km) for using the new diesel engine, the load of diesel engine should not exceed 75% the rated load.

b. First oil change period

For industrial power that the annual service time is less than 500h, the first oil change period should be in (25~30) hours;

For industrial power that the annual service time is more than 500h, the first oil change period should be in (30~35) hours.

Please carry on the routine maintenance of diesel engine according to the relevant instructions in this manual.



1.5 Hoisting of Diesel Engine

When hoisting, keep horizontal the crankshaft center line of engine, and inclined or unilateral hoisting is forbidden. Hoisting and seating should be slow (see Figure 1-3).

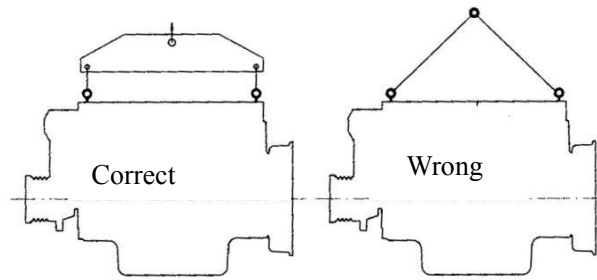


Figure 1-3 Hoisting Diagram of Diesel Engine

1.6 Unsealing of Diesel Engine

When the packing case of diesel engine is opened, the user should first make an inventory of the diesel engine and its accessories according to the packing list before delivery, and check if there is damage on surface of the diesel engine. And if there is looseness of connecting parts and any other problems, after that, continue with following steps:

- ◆ Wipe the antirust coat and corrosion remover and other exposed parts;
- ◆ Drain the oil seal oil inside the fuel filter and the fuel system parts (it is also allowed to start the engine without draining the oil seal oil in the fuel system, but only when the oil seal oil in the fuel system has been exhausted and normal diesel has been supplied, can the engine run with added load).

Notice: the oil seal period of engine is usually one year, any exceeds one year should be checked and necessary complementary measures should be taken on it.

- ◆ Turn the flywheel and spray solvent into air intake pipe, until the oil seal oil in the cylinder is driven out completely.
- ◆ Fill the oil pan with proper lubricating oil as required.
- ◆ The Weichai Power special coolants with freezing points of -25°C , -35°C and -40°C are available. Please choose the coolant based on the local ambient temperatures in such manner that the freezing point of coolant should be 10°C lower than the local air temperature.

1.7 Prestart Preparations for Diesel Engine

- ◆ Check the coolant level

Check the coolant level, if coolant is insufficient, open the liquid filling port cover and add coolant. When opening the liquid filling port cover with relief valve and exhaust button, if the engine is in hot condition, in order to open the cover, it is required to press down the exhaust button. Avoid by all means adding large volume of coolants into the engine when it is in a hot state, because change of cold and hot can cause damage to the parts. If in abnormal conditions there is no coolant, it is allowed to fill in water at not too low temperature, and fill in coolant through the filling port until the coolant overflows. Start the engine, and during the running of the engine (1000 r/min), continue to add coolants to top up the tank until the liquid level is stable, finally cover the filling port with its cover.

- ◆ Check the fuel level

Turn on the switch of power supply, and check the fuel level from fuel gauge or check the fuel tank.

- ◆ Check oil level of diesel engine

The oil level should be between the upper and lower scale marks, if necessary, add oil through the oil filling port.

- ◆ Check if the connection of all kinds of accessories of the engine is reliable, and eliminate abnormal phenomena. Check if the wiring of start-up system is in normal condition and if the storage battery is fully charged. And then open the fuel tank valve, eliminate air in the fuel system with the hand pump on the coarse fuel filter.



1.8 Start-up of Diesel Engine

- ◆ Before start, check if there is pressure in hand operated fuel supply pump, and if the fuel injection nozzle gives off “coo” sound when rotating the diesel engine; if there is neither pressure nor sound, the air in the fuel passage should be exhausted.
- ◆ The starting motor should not work continuously for more than 10s. If the first start failed, the second start should be made 2 min later; if the start failed for more than three successive times, identify and eliminate the fault before trying to start again.

1.9 Running of Diesel Engine

- ◆ After start-up of diesel engine, make the engine run at idle speed for a few minutes, do not enter into running with part of load until the oil pressure is normal, and only when water temperature is higher than 60°C, it is allowed to enter into full-load running. When the diesel engine is running, constantly pay attention to the readings of all kinds of meters, especially oil pressure. Load and speed should be increased gradually, try to avoid sudden increase and decrease of load.
- ◆ During the 60h run-in period, it is suitable for the diesel engine to work under medium load and below.
- ◆ It is unsuitable for the vehicle to run at idle speed, otherwise, oil pumping and other faults will easily occur.
- ◆ In normal working condition, the diesel engine is allowed to continuously run with rated power at rated speed, but if running with 110% of rated power, only 1 hour of working time is allowed in every 12 hours. After unloading, the diesel engine should stop after running for (1~2) minutes at idle speed.
- ◆ The parameter values and check points that should be paid attention to in use:
 - a) Lubricant main gallery pressure: (200~500)kPa; and oil pressure at idle speed should not be lower than 98kPa;
 - b) Oil temperature in main gallery: $\leq 115^{\circ}\text{C}$;
 - c) Temperature at coolant outlet: (75-95) $^{\circ}\text{C}$;
 - d) Temperature after turbine: $\leq 500^{\circ}\text{C}$.
- ◆ Check the exhaust air color in order to identify the working quality and service load of the fuel injector, if there is heavy black smoke or white smoke, stop the engine and check.
- ◆ Note to check if there is water leakage, air leakage and oil leakage of the diesel engine, if there is, stop the engine and troubleshoot.
- ◆ In order to avoid damage to diesel engine, when the engine is working, do not remove the cable leading to pressure regulator of engine and the cable leading to positive electrode of storage battery. Different from DC generator, AC alternator is strictly not allowed to be temporarily connected to earth for power resource check.

1.10 Shutdown of Diesel Engine

- ◆ Before the diesel engine can be stopped, it should be unloaded and decelerated, and should idle for a few minutes. In case of galloping and other failure, you can block the air filter inlet to force the diesel engine to stop.
- ◆ After the diesel engine is stopped, the electricity key should be disconnected to prevent the battery current from flowing back into the excitation ring of silicon rectification dynamo to avoid battery discharging.
- ◆ When the atmospheric temperature is below 0°C, if the engine should be stopped for a long time, the cooling water should be drained off to prevent the engine block from being frost cracked; if antifreezing fluid has been added to the cooling water, and then there is no need to drain water.



Chapter II Maintenance Guide of Diesel Engine

2.1 Fuel, Lubricant, Coolant and Auxiliary Materials Used for Diesel Engine

2.1.1 Fuel

For summer: 0# diesel (GB252)

For winter: usually use -10# light diesel (GB252). But when barometric temperature is lower than -20°C, use -20# diesel, and when outdoor temperature is lower than -30°C, use -35# diesel.

Note: All the fuel used must comply with specifications in Table D1 of Appendix D in National Standard GB 20897-2014.

2.1.2 Lubricant of Engine

First-time oil-filling volume for the engine is 9L. However, the capacity of lubricant is based on the mark of dipstick.

Non-road Stage II series diesel engines use oil of Grade CF-4, and to choose the viscosity of special oil according to temperature; please refer to Table 2-1.

Table 2-1 Selection Specifications for Special Oil of Weichai Power

Product Name	Product Category		Packing Specification
Engine Oil	CF-4	5W-30	4L, 18L, 170kg
		10W-30	
		15W-40	
		20W-50	

Choose the viscosity of special oil of Weichai Power according to temperature; please refer to Table 2-2.

Table 2-2 Corresponding Table of Viscosity and Ambient Temperature

SAE Viscosity Grade	Applicable Ambient Temperature (°C)
0W-20	-35-20
5W-30	-30-30
10W-30	-25-30
15W-40	-20-40
20W-50	-15-45

Note:

- 1) Before the start-up of diesel engine, first check the oil level in the oil sump.
- 2) Do not check the oil level when the diesel engine is running.
- 3) The special oil is not allowed to be mixed with oil from any other manufacturer.

Oil filling volume and quantity of filter elements of 4M06 non-road Stage II stationary industrial power diesel engine, please see Table 2-3.

Table 2-3 Oil Filling Volume and Quantity of Filter Elements

Type	Oil filling volume(L)	Quantity of filter elements	
		Oil filter	Diesel filter
4M06	8	1	1

2.1.3 Coolant of Engine

Freezing points of special coolant are -25°C, -35°C, -40°C, please select special coolants with different freezing points according to local ambient temperature, and the principle of selection is that the freezing point should be lower than local minimum air temperature by 10 degrees or so, please see Table 2-4.



Table 2-4 Special Coolant of Weichai Power for Heavy-duty Engine

Product Name	Product Category	Packing Specification
Coolant for Heavy-duty Engine	HEC-II-25 HEC-II-35 HEC-II-40	4kg,10kg

Note:

1) The coolant must be checked periodically, and to prevent damage caused by corrosion, it should be replaced in time according to the situation.

2) It is forbidden to use water or cooling liquid of bad quality as coolant for engine.

2.1.4 Auxiliary Materials

Table 2-5 Auxiliary Materials for Diesel Engine

No.	Name	Colour	Application and Usage
1	MolykotePulver (fine molybdenum powder)	Black	Apply it on the smooth metal surface in prevent of seizure For example: apply it on outer surface of cylinder liner, etc.
2	Molykote G-N Plus Paste (molybdenum disulfide oil solution)	Dark grey	To act as a lubricant before establishment of lubricating pressure For example: apply it on air intake valve rod, etc.



Table 2-6 Reference List of Sizing of Diesel Engine

Brands	Main Application	List of Sizing Positions	Supplementary Instructions
Weichai special sealant 242	Apply it on surface of thread for immobilization, and prevent looseness by vibration with medium strength	Camshaft thrust bearing bolts Camshaft timing gear bolts Intermediate idler bolts Front end cover bolts Oil filter seat bolts Oil cooler bolts Oil cooler regulating valve bolts Oil pump oil return pipe fixing device bolts Air compressor shaft end thread Strainer bolts Sensor and wiring harness fixing device bolts	As an option, DriLoc204 thread pre-applied coating can be adopted for pre-application.
Weichai special sealant262	Apply it on surface of thread for locking and sealing, and prevent looseness by vibration	Auxiliary bolts of cylinder head	
Weichai special sealant 271	Looseness prevention and fastening	Bowl-shaped plug for blocking oil hole	
Weichai special sealant 277	Used for sealing between core and hole	The rest bowl-shaped plugs	
Weichai special sealant270	Used for the surface of top sealing cylinder head	Rod pushing pipe-cylinder head	
Weichai special sealant518 (an upgrade product of 510)	Apply it on bright metal surface for sealing.	Junction surface of cylinder block and crankcase Front end surface and front end cover of the engine block Connecting plate of rear end surface and flywheel Junction surface of oil filter seat and crankcase Water pump rear cover-engine block front end surface Flywheel housing connecting plate - flywheel housing Junction surface of cylinder block and oil cooler cover Junction surface of cylinder block and oil filling port cover plate	
Silica gel	Apply it on bright metal surface for sealing.	Junction surface of cylinder block and oil cooler cover	

2.2 Daily Maintenance and Service

2.2.1 Daily Maintenance

- ◆ Check the cooling liquid level, oil level and fuel level; and check if the lubricating grease at the



position where it is needed is sufficient;

- ◆ Check if there is oil leakage, water leakage, or air leakage;
- ◆ If connection and fastening of the external parts and accessories are in good condition;
- ◆ If the fan and belts are too tight or too loose;
- ◆ Oil pressure of the diesel engine;
- ◆ Water temperature of the diesel engine;
- ◆ If the exhaust temperature, color, sound and vibration of the diesel engine are in normal condition, and if the speed is stable;

2.2.2 Daily Service

- ◆ Check the cooling liquid level and water temperature.

Observe the cooling liquid level through the glass sight hole, if the coolant is not enough, open the filling port and add the coolant.

Note: When opening the filling port cover, the air exhaust button must be pressed down first in avoid of hurt by coolant when the diesel engine is in hot state.

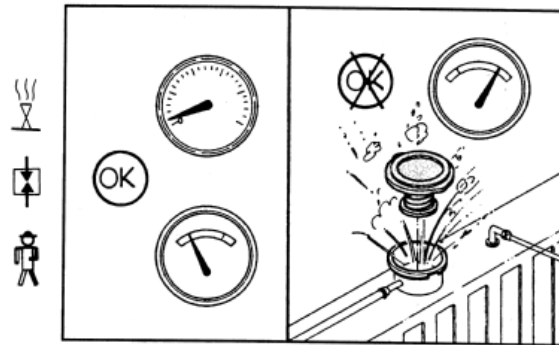


Figure 2-1 Check of cooling liquid level and water temperature

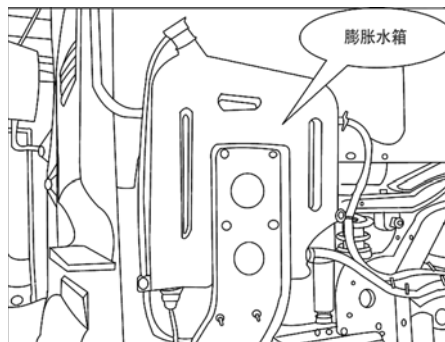


Figure 2-2 Expansion tank

- ◆ Check the oil level.

When the oil level is below the lower scale mark of dipstick or above upper scale mark of dipstick, it is not allowed to start the diesel engine.

If check the oil level after shutdown of the diesel engine, at least wait for 5min to make the oil has sufficient time to flow back to oil sump.

The oil volume difference between lower scale mark and upper scale mark is 3L.



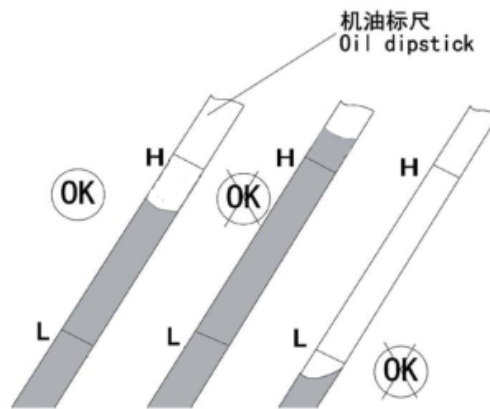


Figure 2-3 Dipstick

- ◆ Check the fuel level.
- ◆ Check for “Three Leakages”.

Check there is no water leakage, air leakage or oil leakage on the vehicle.

- ◆ Check the belt.

Belts of this engine are triangle belts, and users check the tightness of belts through pressing the belts by hand. As shown in Figure 2-4.

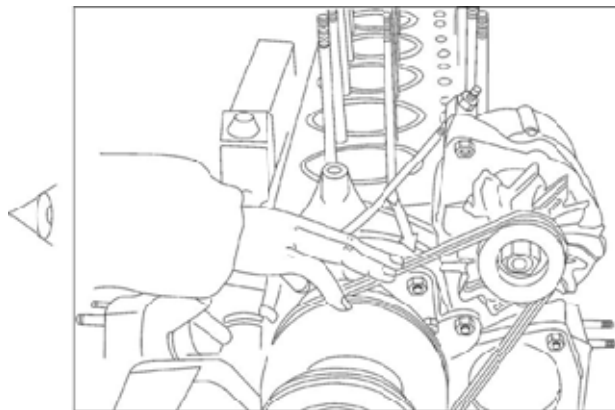


Figure 2-4 Check of belts



Figure 2-5 Check of exhaust air

- ◆ Check if the exhaust air color of the engine is normal.

Normal color of the exhaust air is light grey. When color changes, check for the cause and troubleshoot. As shown in Figure 2-5.

- ◆ Check if the sound of the engine is normal.
- ◆ Check if the speed and vibration of the engine is normal.



2.3 Contents of All Classes of Service

Besides finishing the contents of daily service, below contents also should be added:

◆ Replace oil of the diesel. As shown in Figure 2-6.

- a) Unscrew the oil drain screw plug at the bottom of the oil sump, drain up the oil and tighten the oil drain screw plug;
- b) Open the oil filling port cover, refill oil through the oil filling port, observe the scale of dipstick until it meets requirements, and then tighten the oil filling port cover.

◆ Replace the oil filter or filter elements.

When replacing the oil filter, follow the steps below:

- a) Remove the old oil filter;
- b) Fill up the new filter with clean oil;
- c) Before assembling the new oil filter, apply oil on the sealing gasket;
- d) After the gasket contact with the base, tighten again by 3/4-1 round, and make it sealed;
- e) Start the diesel engine and check if there is oil leakage.

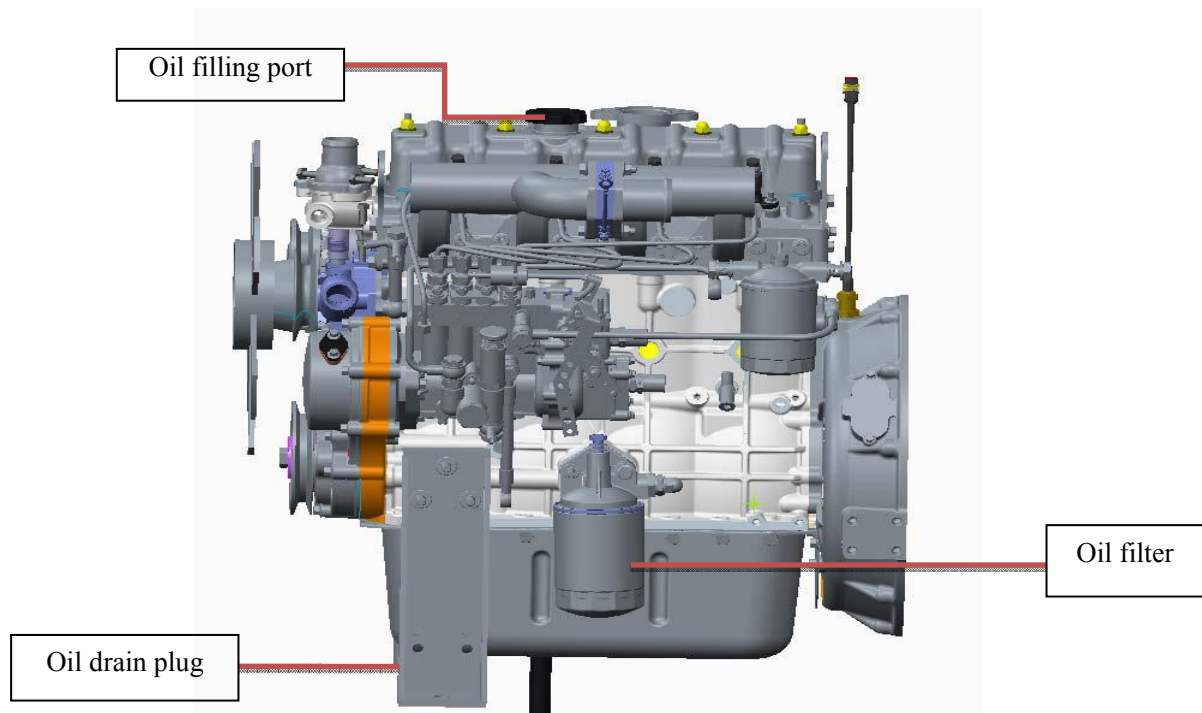


Figure 2-6 Oil drain screw plug, oil filling port and oil filter

◆ Check and adjust air intake and exhaust valve clearances

When checking and adjusting air intake and exhaust valve clearances, follow below steps to operate:

- a) When the diesel engine is at cold state, turn the crankshaft clockwise (in the same direction where the diesel engine rotates) until the pistons of Cylinder 1 and Cylinder 4 reach their TDCs respectively. At this moment, the OT scale mark of crank pulley aligns with the pointer above it.
- b) Disassemble the valve rocker arm cover on the cylinder head, and judge if Cylinder 1 or Cylinder 4 is in its compression stroke (there are clearances between air intake and exhaust pipes and rocker arm of cylinders which are in their compression strokes). As shown in Figure 2-7.





Figure 2-7 Adjustment of valve clearance

c) As shown in Figure 2-7, use a feeler gauge to check the clearance between upper plane of the valve and rocker arm of the valve. If the clearance is too large or too small, it is possible to meet the clearance requirements by adjusting the adjusting bolts on the rocker arm. In cold state, clearance of the air intake valve is required to be 0.35mm, and clearance of the air exhaust valve is required to be 0.25mm.

d) After check of Cylinder 1 or Cylinder 4, turn the crankshaft clockwise again by 360° so that Cylinder 1 or Cylinder 4 is at TDC of its working stroke, and then check and adjust the rest valves.

Table 2-7 Status of All Cylinders in Compression Stroke

	Cylinder 1	Cylinder 2	Cylinder 3	Cylinder 4
Compression stroke of cylinder 1	Intake and exhaust valves	Intake valve	Exhaust valve	Nonadjustable
Compression stroke of cylinder 4	Nonadjustable	Exhaust valve	Intake valve	Intake and exhaust valves

◆ Replace the fuel filter element. As shown in Figure 2-8.

When replacing the fuel filter element, follow the steps below:

- Disassemble the old fuel filter elements; if the water collecting vessel installed on the coarse filter can be used again, please remove the water collecting vessel.
- Lubricate the seal end;
- Screw up the fuel filter until the seal end is connected with the connector;
- Continue to screw the filter until the filter is securely installed (by about 3/4 rounds);
- Exhaust the air until no air bubble appears;
- Conduct leakage test.



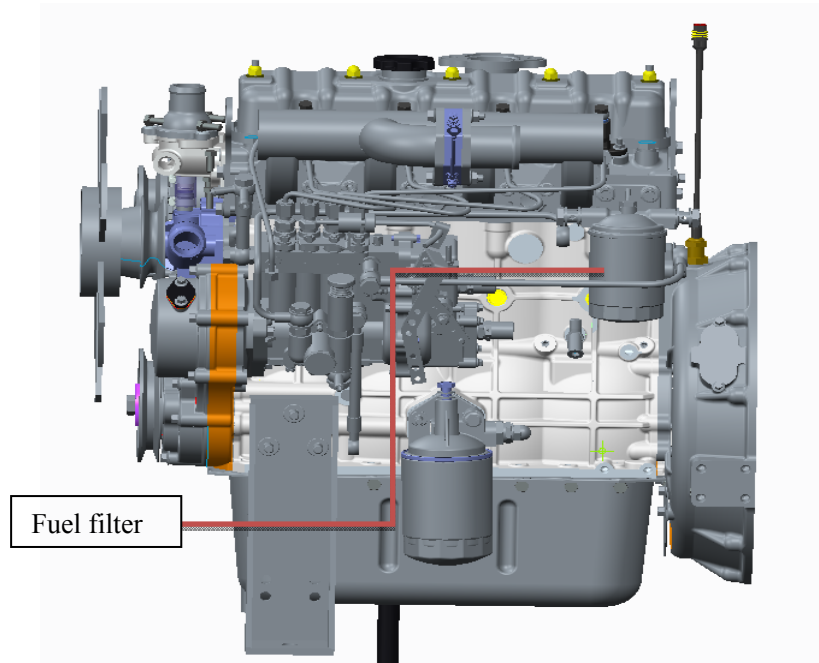


Figure 2-8 Fuel filter

◆ Check the air intake system

Check if there is aging or crack of the air intake rubber tube, and if the strap is loosened. If necessary, fasten or replace the parts to ensure the air tightness of the air intake system.

◆ Check the air filter element. Figure 2-9 schematic diagram of air filter

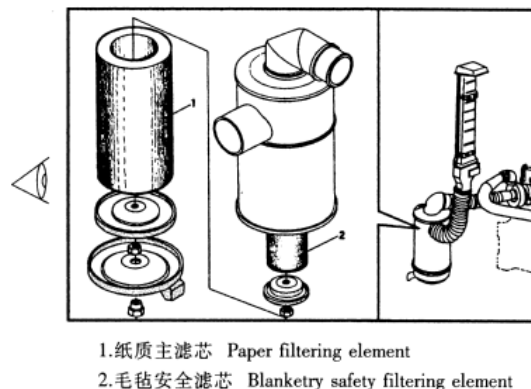


Figure 2-9 Air filter

The maximum allowed air intake resistance is not larger than 3.5kPa, and the maximum air intake resistance must be checked when the engine is running at rated speed with full load, when the air intake resistance reaches its maximum value allowed, it is required to clean or replace filter elements as specified by the manufacturer.

Note: It is not allowed to use the diesel engine without air filter, or else, dust and impurities will enter the diesel engine, which will cause early wearing of the diesel engine.'

Remove the air filter elements from the air filter, lightly pat the end face to make dust fall, it is also possible to use compressed air to blow reversely (blow from inside out). Figure 2-10 Schematic Diagram of Cleaning of Filter Element.



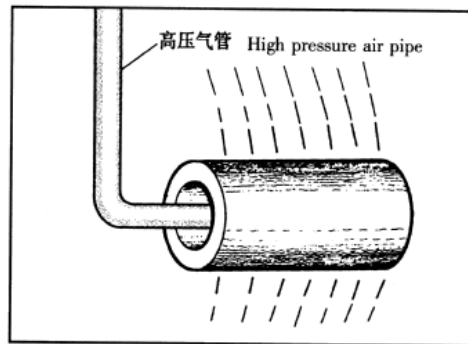


Figure 2-10 Cleaning of filter element

Note:

- 1) **Do not blow through the filter paper;**
- 2) **Do not wash the filter paper with water or oil;**
- 3) **Do not pat or knock the filter paper forcibly.**

2.4 Maintenance for Long-Term Storage of Diesel Engine

- ◆ Cleaning of diesel engine;
- ◆ Protection work:
 - a) After warm-up of the engine, drain the oil, clean the oil filter, and add antirust oil;
 - b) Drain the fuel, and refill with antirust oil mixture;
 - c) Drain the water, and add coolant with antirust agent;
 - d) Start the engine, and make it run for 15~25 minutes at idle speed;
 - e) Drain the oil, fuel and coolant;
 - f) Protect other parts;
- ◆ Protection during storage:

Block off the inlets and outlets of oil, air and water with covers or through binding with plastic cloth, and seal and store the whole diesel engine with VCI film.

- ◆ If in need of transportation, outer packing shall be added.



Chapter III Typical Faults of Diesel Engine and Treatment

4M06 Non-road Stage II Stationary Industrial Power Diesel Engine is designed and manufactured under strict quality guarantee system, every engine has passed specified test before delivery from the factory. At the same time, diesel engine is a kind of precision machine; long term guarantee of its utility cannot be separated from regular maintenance. Early failure of the engine is usually caused by several reasons below:

- 1) Operation against regulations, bad management and use;
- 2) Not maintained and preserved as required, and even replaces maintenance by repairing;
- 3) Poor parts manufacturing, especially the counterfeit and shoddy products purchased will greatly shorten the life of the diesel engine;
- 4) Fuel or lubricant brand chosen is inappropriate or unqualified.

3.1 Diagnostic Method

Common diagnostic methods for diesel engine faults are usually as following:

- ◆ Observation method: Judge the fault through observing smoke exhaust and other fault characteristics of diesel engine (See Figure 3-1)
- ◆ Auscultatory method: According to abnormal sound of the diesel engine, judge the position, nature and degree of the fault by auditory sense (See Figure 3-2)



Figure 3-1 Observation Method



Figure 3-2 Auscultatory Method

- ◆ Cylinder-stopping method: Stop one of the working cylinders to judge if the fault exists in this cylinder. Cylinder-stopping method usually means to cut off fuel supply to the cylinder where fault is suspected to exist, and compare the state change of engine before and after stop of this cylinder, narrowing the range for looking for fault position or reason further.
- ◆ Comparison method: Adopt the method of replacement to confirm if there is fault in some assemblies or parts.

Note:



a. Judging the fault reason of the diesel engine is a job which needs high carefulness, before basically finding out the reason; do not disassemble the engine at will, otherwise, instead of eliminating the fault, wrong assembly after disassembly might cause more serious faults.

b. For the high-pressure fuel pump and other key parts, not only special instruments and equipment are needed but also staff with certain experience for maintenance and check, so customers who has no experience or conditions shall not disassemble or adjust them at will.

3.2 Causes for Common Failure of Diesel Engine and Solutions

3.2.1 Start-up Failure of Diesel Engine

Cause	Solutions
If the starter works	If not, first eliminate fault in circuit of electric appliances
Temperature is too low	Add auxiliary equipment for start-up
Air exists in the fuel system	Eliminate the air, check airtightness of connectors, and repair it
Blockage of fuel intake strainer of fuel delivery pump or tube and other fuel way	Check and remove dirt, and check cleanliness of the fuel
Fault of fuel injection pump	Check plunger and fuel outlet valve, and repair or replace damaged parts
Damage or fuel leakage of distributing or fuel supply pipes	Check and adjust it
High-pressure fuel pipe damage or fuel leakage	Repair or replace it
Fault in fuel injector	Check the atomization of fuel injector
Inadequate cylinder compression pressure	Check the airtightness of valve and cylinder gasket, and the wearing of piston rings, repair or replace them

3.2.2 Shutdown of Engine before Long after Start-up

Cause	Solutions
Air exists in the fuel system	Check the tightness of oil pipes and connectors, check if the bleeder screw is tightened up, eliminate the stored air
Fuel filter blockage	Disassemble the filter body, eliminate the dirt and water inside it, if necessary, replace the filter elements
Low quality of fuel, containing too much water	Clean the filter, replace the fuel
Fuel delivery pump doesn't work	Check fuel delivery pump piston and valve, clean and repair them
Idlespeed governing is too low.	Carry out readjustment

3.2.3 Insufficient Power

Cause	Solutions
Intake air blockage (blockage of air filter)	Check the air filter and air inlet pipe, and clean or replace the filter element
Exhaust air back pressure is too high	Check valve timing, and if there is blockage in exhaust pipelines, adjust and repair it
Fuel leakage or blockage in fuel pipelines	Check tightness of pipelines and connectors, pollution degree of filter and repair of fuel pipelines or eliminate dirt, and replace filters
Low quality of fuel	Clean the fuel tank, filter parts and fuel pipes, and replace



	fuel
Excessive wearing of fuel injection pump	Repair or replace it
Bad atomization of fuel injection nozzle	Check fuel injection pressure, carbon deposit in fuel injection nozzle, and adjust and repair it
Incorrect valve or fuel supply timing	Check and adjust it
Oil level in oil sump is too high	Check dipstick, drain the excessive oil
Air leakage of cylinder gasket	When warming the engine, check compression pressure, replace damaged cylinder gasket
Piston ring is worn or broken, bearing bush clearance is too large	Replace worn parts, or overhaul the diesel engine
Wearing of cylinder liner or piston, or scuffing of cylinder	Overhaul the diesel engine

3.2.4 Excessive Consumption of Fuel

Cause	Solutions
Blockage of air intake pipe	Check air filter, air intake pipeline, and clean them
Exhaust air back pressure is too high	Check air exhaust pipe, and clean it
Low quality of fuel	Replace fuel as required
Blockage of fuel pipeline	Check and repair it
Fuel leakage in fuel pipelines	Check and repair it
Bad atomization of fuel injector	Check and adjust, or repair it
Incorrect valve or fuel supply timing	Adjust valve clearance and fuel supply advance angle as required
Air leakage of cylinder gasket	Check compression pressure
Bearing bush clearance is too large, and the diesel engine needs overhaul	Check and overhaul
Swelling of piston in the cylinder	Replace cylinder liner, piston and piston ring

3.2.5 Black Smoke Emits from Exhaust Air

Cause	Solutions
Blockage of air intake pipe or exhaust air back pressure is too high	Clean it
Low quality of fuel	Clean and replace it
Incorrect valve or fuel supply timing	Adjust as required
Bad atomization of fuel injection nozzle	Check, repair or replace it
Excessive fuel in fuel injection pump	Check and adjust it

3.2.6 White and Blue Smokes Emit from Exhaust Air

Cause	Solutions
Low quality of fuel, containing too much water	Replace the fuel
Temperature of cooling water is too low	Check the working temperature of thermostat, if necessary, replace it
Bad atomization of fuel injection nozzle	Check and repair it
Incorrect valve or fuel supply timing	Check and adjust it



Compression pressure is too low, incomplete combustion and swelling of piston in cylinder	Check the piston ring, cylinder liner and cylinder gasket, and repair them
Bad running-in of piston ring and cylinder liner	Go on with running-in
The openings of piston rings are not staggered	Adjust and reassemble
Failure of oil ring of piston	Replace it
Fit clearance between piston and cylinder liner is too large	Repair and replace

3.2.7 Unstable Speed

Cause	Solutions
Low quality of fuel, containing water or wax	Replace the fuel
Air leakage into fuel sucking pipe	Check the tightness of oil pipes and connectors, eliminate the stored air
Uneven fuel supply	Check and adjust
Unstable atomization of the fuel injection nozzle	Check and repair it

3.2.8 Overflow Oil Pressure

Cause	Solutions
Overflow oil level in oil sump or lack of oil	Check oil level and if there is oil leakage, and add oil
Oil brand cannot meet the specifications	Replace the oil as specified, and choose oil of appropriate brand
Water temperature of cooling system is too high, and the oil temperature is too high	Check the working condition of cooling system
Resistance of oil filter is too large	Replace with new filter elements
Blockage of oil cooler	Check and clean the oil cooler.
If there is blockage or crack on strainer, oil pipeline, connector gasket and so on	Check and clean air compressor passage, remove dirt blockage, and eliminate carbon deposit in exhaust air passage
Leakage of oil intake pipe of oil pump	Check the oil pipe and connector, repair or replace them
Fault of pressure regulating valve of main oil gallery	Check valve, clean and repair it
Blockage of main oil gallery	Check and clean the oil cooler
Bearing bush clearance is too large, or bearing bush is damaged	Check and replace
Parts are excessively worn, and need overhaul	Check the working of engine, overhaul it
Diesel fuel leaks into oil.	Check if there is smell of diesel fuel in the smells, or measure the flash point of oil should not be lower than flash point of new oil

3.2.9 High Temperature of Cooling Water

Cause	Solutions
Water level in water tank is too low	Check if the tank is leaky and add water if necessary
Cooling fin of water tank is blocked	Clean the cooling fins of water tank



The water pump belts are loose	Adjust the tension of belts as per specifications
The water pump gasket is damaged, or the water pump impeller is worn out	Check and repair or replace them
Water pipe damage, and air leakage into it	Check the water pipe, connection, gasket, etc. and replace any damaged parts
The thermostat is faulty	Replace it
The water tank is blocked	Check the water tank, and clean or repair it if necessary
Overflow oil level in oil sump or lack of oil	Check the oil level and find out the leaking points, and repair them and then add oil

3.2.10 Overfast Wearing of Parts

Cause	Solutions
Unqualified air filter elements, or damage	Check and replace for qualified filter elements
Short-circuit of air intake system	Check air intake pipe, gasket and connecting pipe sleeve, repair or replace
Oil filter elements are not replaced in time	Replace as required
Overflow oil level in oil sump or lack of oil	Check the oil level and find out the leaking points, and repair them and then add oil
Oil brand cannot meet the specifications	Replace the oil as specified
Quality of oil used cannot meet the requirements	Choose oil of brand which can meet standard specifications
Blockage of oil gallery	Clean the oil gallery
Piston ring is worn or broken	Replace the damaged parts
Wearing of cylinder liner or piston, or scuffing of cylinder	Disassemble the piston and cylinder liner, repair or replace them
Crankshaft and axes of driven parts are not coaxial	Check the installing support, and repair
Parts are excessively worn, and need overhaul	Check mileage, confirm overhaul

3.2.11 Overloud Noise

Cause	Solutions
Low quality of fuel	Replace fuel
Temperature of cooling water is too low	Check thermostat, replace if necessary
Incorrect valve or fuel supply timing	Check and repair or adjust
Bad atomization of fuel injection nozzle	Check and repair or adjust
Fuel volume in fuel injection pump is too large	Check and adjust
Air leakage in valve or wrong adjustments	Disassemble the valve, and adjust
Gear clearances are too large or gear is broken	Check and replace damaged parts
Wearing of cylinder liner or piston, or scuffing of cylinder	Check and repair or replace them
Push rod bending or break, rocker arm break	Replace it
Piston ring is worn or broken	Check and replace damaged parts



3.2.12 Starter Motor Doesn't Work

Cause	Solutions
Fuse blow	Replace fuse
Bad contact of connection wires	Tidy up the circuit, screw up the binding posts
Storage battery undercharged	Check, charge or replace battery
Short-circuit of starter motor itself	Overhaul the motor or replace assembly
Bad contact of electric brush	Clean the surface of electric brush or replace the electric brush

3.2.13 Inability of Starter Motor

Cause	Solutions
Storage battery undercharged	Charge or replace the battery
Wearing of bearing bush	Replace the assembly
Unclean commutator or singeing	Remove the oil stain and polish with sand paper or replace the assembly
Sealing-off on the cable end	Reweld
Bad contact of switch	Check the switch and repair
Slippery clutch out of wearing	Adjust the working torque of clutch or replace the assembly

3.2.14 Undercharge of Alternator

Cause	Solutions
Wiring open-circuit and short-circuit, looseness of connectors	Repair
Open-circuit and short-circuit of rotor and stator coils or bonding	Repair or replace the assembly.
Looseness of alternator belt	Check and adjust belt tension
Damage of rectifier tube of engine, bad contact of battery	Repair
Regulator voltage is adjusted too low	Carry out adjustment
Disconnection of regulator field coil or resistance wiring	Repair or replace
Too little battery acid, or old battery	Refill battery acid, or replace battery



Chapter IV Disassembly and Assembly of Engine

4.1 Overview

When disassembling and assembling the natural gas engine, please strictly operate according to instructions in this manual, and take care of the operations marked with danger sign and safety sign in order to ensure personal safety, avoiding accidents.

Because disassembly steps of diesel engine are opposite to assembly steps, except that special instructions are needed, only one of them is specified in this manual.

Tightening torque of special bolts will be specified in relevant assembly steps, except special instructions, please refer to Appendix A.

4.1.1 Danger Sign



This is a worldwide recognized warning sign. In this manual, this sign is used to highlight the importance of information below. Make sure that you have learned about the consequence of these dangers and ways to avoid these dangers. Any behavior breaching the warning information may lead to property loss, personal injury and even casualties.

The danger signs we commonly see is usually used for ordinary warning. In this manual, warning information is divided into different kinds (minor injury, serious injury and death) according to the classes of consequences may be caused.



This warning sign indicates a potential dangerous situation, if it fails to avoid this situation, serious injury, even death or larger property loss can be caused.



This warning sign indicates a potential dangerous situation, if it fails to avoid this situation, minor injury or property loss can be caused. This warning sign is also used for warning of dangerous operation.

The information provided in these notes is used for instructing how to operate and install the product in a right way. However, all these dangerous situations cannot be eliminated by simply reading this document. Only correct understanding of the information included in these notes can help to use it in the right way.

The warning information in this guide cannot cover all possible situations! If the program and method you have decided to use are with the recommended range, please make sure this operation will not bring any danger to you or others or the equipment.



4.1.2 Safety Sign

Table 4-1 Safety Sign

Picture	Definition
	Put on hand protectors
	Put on ear protectors
	Put on eye protectors
	Put on head protectors
	Put on foot protectors
	Put on face shield
	Put on protective clothing
	No open flame
	No smoking
	No cellphone
	Danger: Storage battery acid liquor
	Danger: Live cable, electric shock hazard
	Flammable materials
	Keep away from objects hanging load
	Fire extinguisher available nearby

During the use of diesel engine, many potential dangers may occur without warning. Therefore, this manual cannot provide warning for every potential danger. If the program you use is not within the range especially recommended, please make sure the program is running safely and will not cause any material loss.

4.1.3 Tools to Use

Table 4-2 Tools to Use

Picture	Definition
	2.5mm wrench
	5mm hexagon wrench
	8mm sleeve
	Plain end screwdriver
	Special tool
	10mm plain hand hexagon wrench

If the method or tool used is not within the range recommended in this manual, the user must first ensure



the personal safety in avoid of life risk brought to the user or other people, at the same time ensure that the methods for use, maintenance or repair will not cause damage risk or threat to safety.

4.1.4 Notes for Health-keeping

Following “Notes for Health-keeping” aims to reduce risks of being contaminated.

- a) Avoid contacting used oil repeatedly for a long time.
- b) If you can, please wear protective clothing, and wear waterproof gloves.
- c) Please do not put oil stained rag into pockets of clothing.
- d) Avoid oil or liquids from contaminating clothing, especially underwear.
- e) Wash the uniforms frequently. Discard the clothing and shoes stained with oil and liquids which cannot be cleaned up.
- f) If cut or injured, please take emergency measures immediately.
- g) Before work, be sure to use protective cream; it will make oils and liquids easier to eliminate when skin is contaminated with mineral oil.
- h) Use soap and hot water, or use hand sanitizer and nail brush to wash hands in order to eliminate all oil stains. If grease naturally secreted by skin is washed off, products containing lanolin can replace the grease secreted by skin, which is helpful for moistening skin.
- i) Gasoline, kerosene, fuel, thinner or solvent shall not be used to clean skin.
- j) If it feels discomfort of skin, please see the doctor immediately.
- k) If possible, remove oil from parts before transportation
- l) When both eyes are endangered, please use goggles or face shield. Eye flushing fluids should be prepared at a place near at hand.
- m) When repairing the engine, oils and fluids shall not be splashed onto the ground. If hydrocarbon or any other fluid leaks by accident, take all necessary measures to isolate this area in order to remain the environment clean and protect staff against injuries.
- n) Transportation, storage and reclamation of hydrocarbon, ethylene, glycol or petroleum must comply with the safety and environmental standards implemented by the country where the operation is carried out.

4.1.5 Environmental Protection Measures

About disposal of waste oil and hydrocarbon, please comply with relevant environmental protection laws and regulation. Please refer to local officials for more details.

4.1.6 Notes for the Process of Disassembly and Assembly

Most accidents relating use, maintenance and repair of diesel engine result from failure to comply with safety rule and basic notes. Therefore, you should realize the danger faced with and take corresponding preventive measures to avoid accidents. To operate, maintain and repair the diesel engine, you should experience corresponding training, command applicable skills and use proper tools.

Breach of relevant instructions specified in this manual may cause serious accident, and even endanger your life. Weichai Power Co., Ltd. cannot foresee all potential dangers. Similarly, norms and instructions specified in this manual are really not exhaustive.

Before continuing with operations of maintenance or repair, put an indicator written with “Please don’t use it” or a similar sign on the switch of starter.

When using the crowbar for turning the crankshaft, necessary preventive measures should be taken accordingly

Make sure that the field for repair and surroundings is proper for safety operations.

Make sure that the maintenance workshop or the area near the engine is clean and tidy.



Before work, please put off ring, necklace and watch. Please put on a fitting uniform.

Before work, please check if corresponding protective equipment are (glasses, gloves, shoes, face shield, uniform, helmet and so on) in valid period.

Please don't use tools with fault or inappropriate.

During maintenance or repair, please shut down the diesel engine.

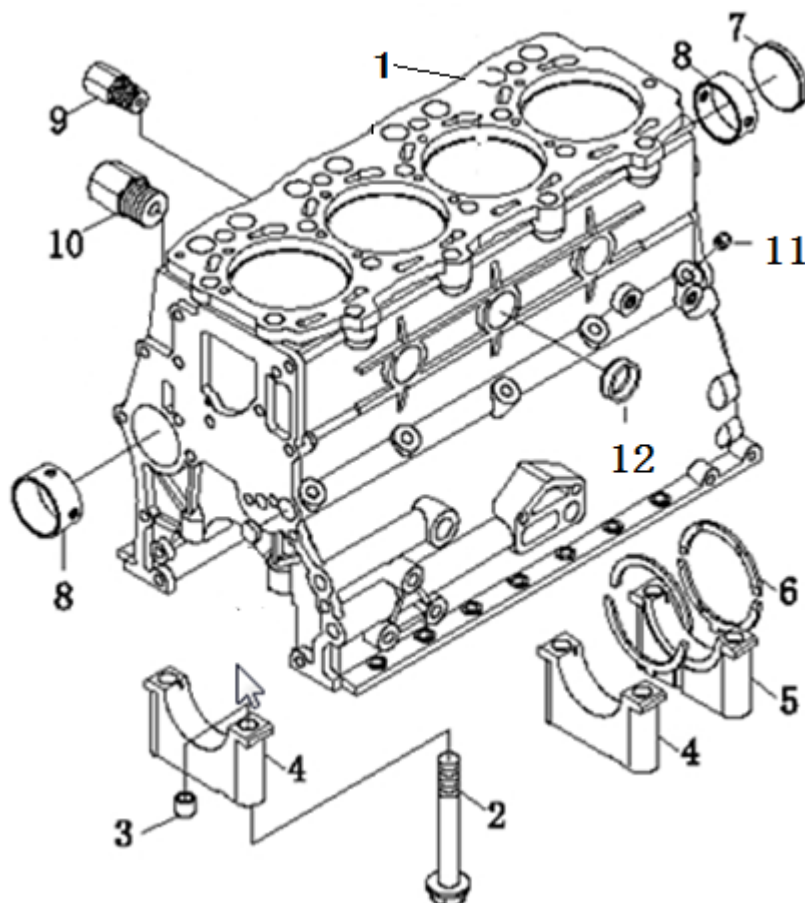


4.2 Engine Block Combination

4.2.1 Disassembly and Assembly of Engine Block Combination

4.2.1.1 Explosive View of Engine Block

Engine block combination mainly includes machining assembly of engine block, blanking plug, camshaft hole blanking cap, camshaft bush, main bearing cover and other parts. Assembling positions of all parts of it are as shown in Figure 4-1:



1. Engine block	2. Main bearing cover bolt	3. Locating sleeve
4. Main bearing cover	5. Rear main bearing cover	6. Thrust plate
7. Camshaft hole blanking cap	8. Camshaft bush	9. Oil intake connector
10. Oil return connector	11. Blanking cap	12. Screw plug

Figure 4-1 Explosive View of Engine Block Combination

4.2.2 Disassembly and Assembly of Screw Plug of Engine Block

[Assembly Steps]

(1) Align the screw plug of engine block (apply sealant to the surface of screw plug thread evenly) with the installation hole on the engine block, and screw in by hand for 2-3 teeth, finally, tighten up the screw plug with pneumatic wrench.

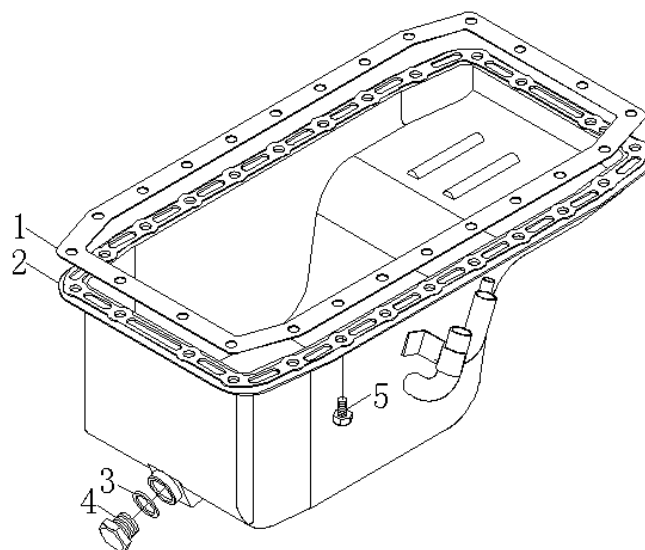
[Disassembly steps:] Operate in the order opposite to above assembly steps.

[Note] Screw plug of engine block is assembled with sealant. When disassembling, take care not to damage the threads.



4.2.3 Disassembly and Assembly of Oil Sump

4.2.3.1 Explosive View of Oil Sump



1.Oil sump gasket 2. Oil sump 3. Oil drain screw plug gasket 4. Oil drain screw plug 5. Bolt

Figure 4-2 Explosive View of Oil Sump Combination

4.2.3.2 Disassembly and Assembly of Oil Sump

[Disassembly steps]

- (1) Overturn the diesel engine, with the oil pan facing upward;
- (2) Disassemble oil sump fastening bolts;
- (3) Use a shovel blade to shovel out the position where sealant exists;
- (4) Disassemble oil sump and seal gasket;
- (5) Disassemble the oil drain screw plug, sealing washer and screw plug support.

[Assembly Steps]

- (1) Wipe the junction surface of engine block and oil sump, apply type 87 silica gel on the junction surface of engine block and gear chamber cover and rear oil seal cover, and apply type 87 silica gel on both sides of the gasket at the position of oil pump.
- (2) Put the oil sump gasket on the bottom surface of engine block, take out the oil sump and weld it on, and align with the bottom surface of engine block to install the oil sump.
- (3) Tighten up the bolts and nuts with a pneumatic anchoring force torque wrench. The concrete tightening order is from middle to both sides.

[Note] When applying sealant, the sealant line must be continuous and uniform, break points are not allowed.

4.2.3.3 Overhaul of Oil Sump

Key point 1: Disassembly

Before disassembly of oil sump, presently drain up the oil. Put the vessel containing oil under the oil sump oil-draining screw plug, and use a screw plug wrench to loosen oil-draining screw plug, then discharge the oil.

Key point 2: Assembly

- (1) Apply sealant along the inside of screw hole on the engine block junction surface.
- (2) Move the oil sump to make it align with engine block junction surface, when oil sump contacts with

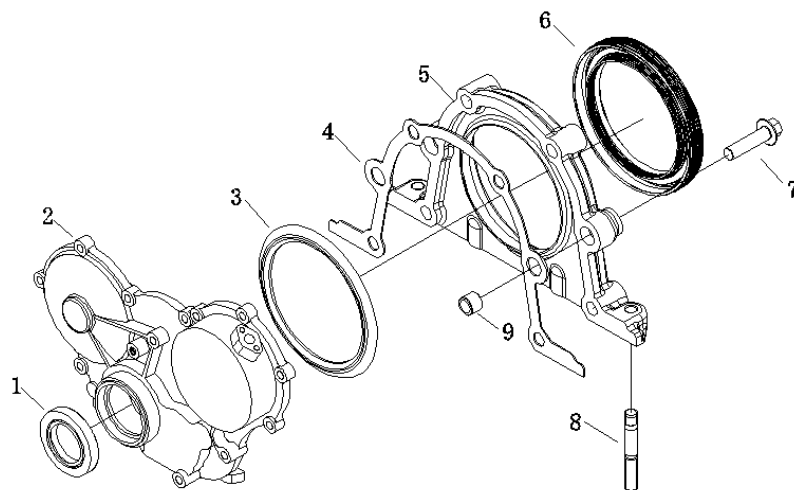


engine block, it is required to put it down gently in avoid of junction surface damage by collision;

(3) Install the bolts and gaskets; the tightening order of oil sump bolts is from middle to both sides.

4.2.4 Disassembly and Assembly of Front and Rear Oil Seals

4.2.4.1 Explosive View of Front and Rear Oil Seals



1. Front oil seal	2. Gear chamber cover	3. Rear oil baffle disc	4. Rear oil seal cover gasket
5. Rear oil seal cover	6. Rear oil seal	7. Bolt	8. Double end stud
9. Locating pin bush			

Figure 4-3 Explosive View of Oil Seals Combination

4.2.4.2 Disassembly and Assembly of Front and Rear Oil Seals

[Assembly Steps]

- (1) Use special tooling to steadily press the rear and front oil seals in (before assembly, lubricant should be applied to front and rear faces of oil seals);
- (2) Screw the double end stud into rear oil seal cover;
- (3) Use a copper hammer to stamp the locating pin bush to the bottom;
- (4) Install the oil baffle disc to the crankshaft, assemble the rear oil seal cover together with rear oil seal cover gasket, and fix it to the engine block with hexagon flange face bolts.

[Disassembly steps]

Disassemble it in the order opposite to above assembly steps.

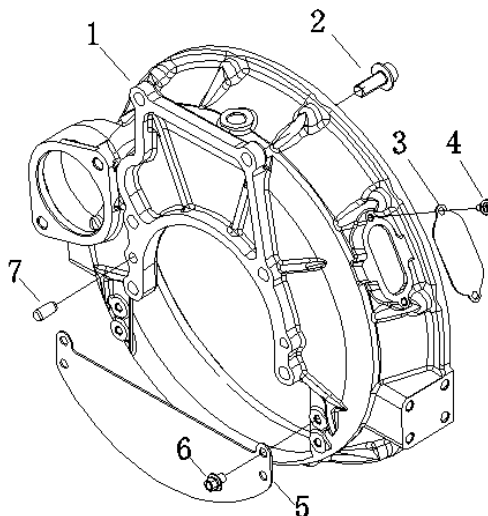
[Note]

- (1) Check if the rear oil seal cover gasket is damaged, if oil seal rubber is damaged, if rear oil seal cover is clean and if there is scratch on machining face;
- (2) Before assembly, clean the junction surface of rear oil seal cover and engine block, and wipe out the junction surface;
- (3) During disassembly, operate carefully in avoid of scratching crankshaft assembly;
- (4) Avoid secondary use of oil seals, after the disassembly of the engine, and replace for new rear and front oil seals.



4.2.5 Disassembly and Assembly of Flywheel Housing

4.2.5.1 Explosive View of Assembly of Flywheel Housing Combination



1. Flywheel housing	2. Hexagon flange face bolt	3. Flywheel housing peelhole cover
4. Hexagon flange face bolt	5. Cover plate	6. Hexagon bolt
7. Cylinder pin		

Figure 4-4 Explosive View of Flywheel Housing Combination

4.2.5.2 Disassembly and Assembly of Flywheel Housing

[Assembly Steps]

- (1) Wipe the junction surface of flywheel housing and engine block with a clean towel.
- (2) Check the cast marks of flywheel housing manufacturer, and write down the marks at corresponding part on the assembly process card, and correctly record these marks of flywheel housing manufacturers.
- (3) Align with the screw hole, install the flywheel housing, and screw in the bolt by 2-3 teeth by hand.
- (4) Starting from the locating pin, use a pneumatic wrench to tighten up the bolts symmetrically and uniformly in 2-3 times.

[Disassembly steps]

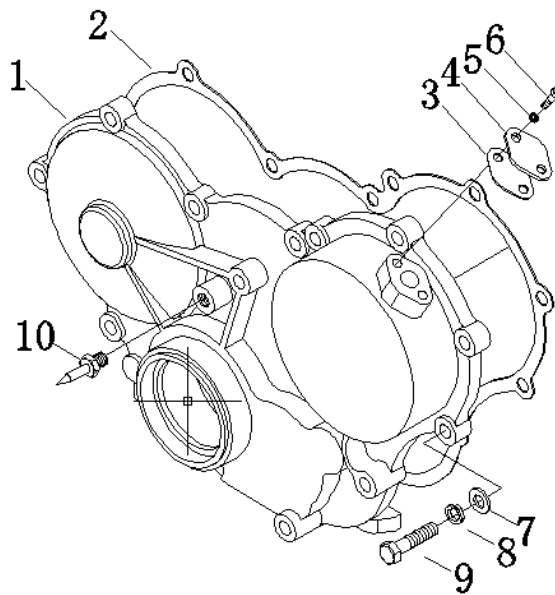
- (1) Disassemble the cover plate fastening bolt 6, and disassemble cover plate 5;
- (2) Disassemble and remove the flywheel housing fastening bolt 2 diagonally;
- (3) Disassemble the flywheel housing 1, and cylinder pin 7.

[Note] Note to apply lubricant when assembling clutch housing bolts which can be repeatedly used for twice.



4.2.6 Disassembly and Assembly of Gear Chamber Housing

4.2.6.1 Explosive View of Assembly of Gear Chamber Housing



1. Gear chamber cover	2. Gear chamber cover gasket	3. Observation hole cover gasket
4. Observation hole cover	5. Washer	6. Hexagon bolt
7. Flat washer	8. Spring washer	9. Hexagon bolt
10. Timing pointer		

Figure 4-5 Explosive View of Gear Chamber Cover

4.2.6.2 Disassembly and Assembly of Gear Chamber Housing

[Assembly Steps]

- (1) Knock the locating pin into the gear chamber cover.
- (2) Install the gear chamber cover gasket and gear chamber cover, install bolts and tighten up gear chamber cover bolts diagonally in order.
- (3) Install the bonded washer, and tighten up adjusting screw plug.
- (4) Install the timing pointer.

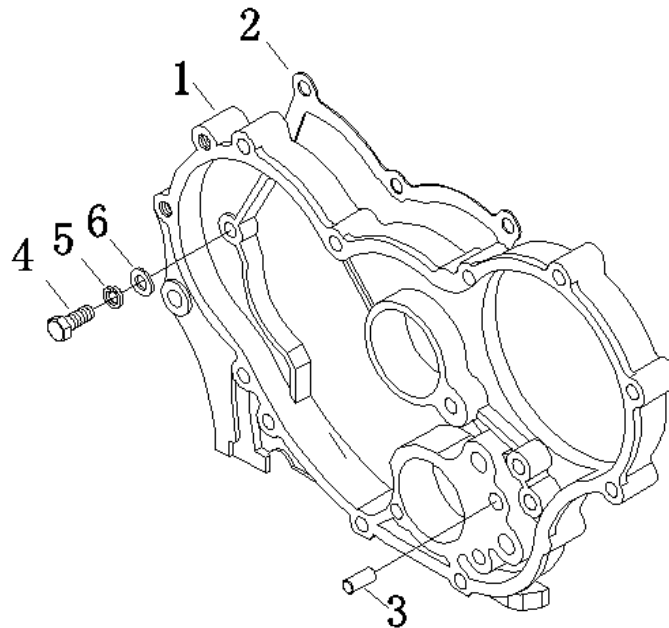
[Disassembly Steps] Operate in the order opposite to above assembly steps.

[Note] Avoid secondary use of bonded washers, after disassembly of engine, replace for new bonded washers.



4.2.7 Disassembly and Assembly of Gear Chamber

4.2.7.1 Explosive View of Assembly of Gear Chamber



1. Timing gear chamber	2. Gear chamber gasket	3. Cylinder pin	4. Hexagon bolt
5. Spring washer	6. Flat washer		

Figure 4-6 Explosive View of Gear Chamber Cover

4.2.7.2 Disassembly and Assembly of Gear Chamber

[Assembly Steps]

- (1) Knock the locating pin (no edge failure with locating pin) into the front end of cylinder block.
- (2) Install the gear chamber gasket and gear chamber, tighten up gear chamber bolts diagonally in order.
- (3) Install transition gear shaft, wipe out it, and check if there is damage by collision on it, install a pair of bearings, and apply adequate clean lubricant; install transition gear and transition gear shaft pressing plate in order.
- (4) Install bolts, and tighten the bolts in place.

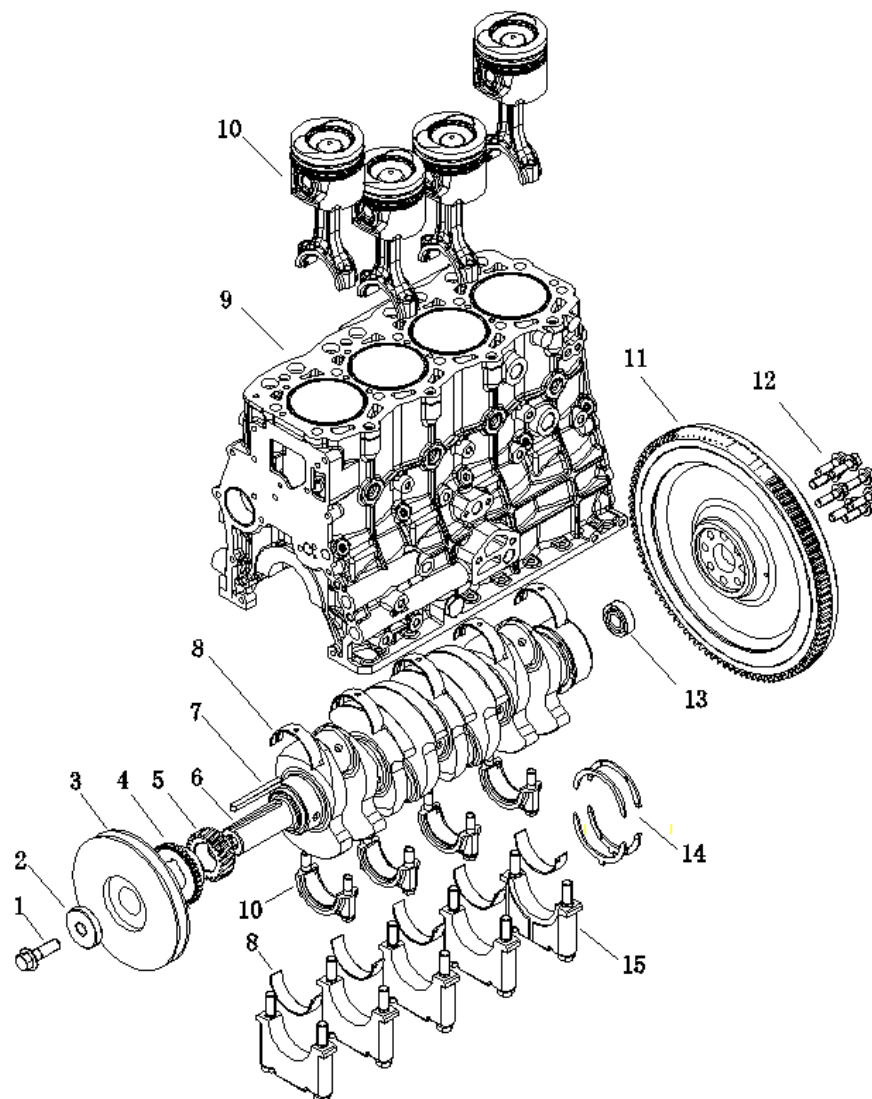
[Disassembly Steps] Operate in the order opposite to above assembly steps.



4.3 Crank-Connecting Rod Mechanism

4.3.1 Disassembly and Assembly of Crank-Connecting Rod Mechanism

4.3.1.1 Explosive View of Crank-Connecting Rod Mechanism



1.Crankshaft pulley bolt	2.Crankshaft pulley pressing plate	3.Crankshaft pulley
4.Oil pump driving gear	5.Camshaft timing gear	6.Crankshaft
7.Key	8.Main bearing bush	9.Engine block
10.Pistong connecting-rod	11.Flywheel ring gear subassembly	12.Flywheel bolt
13.Bearing	14.Thrust plate	15.Main bearing cover

Figure 4-7 Explosive View of Crank-Connecting Rod Mechanism

4.3.1.2 Disassembly and Assembly of Crank-Connecting Rod Mechanism

[Disassembly Steps]

- (1) Check before disassembly. Check the axial backlash of connecting rod, and check tightening torque of connecting rod bolt; Incline the engine and lay it sideways.
- (2) Turn the crankshaft to make the piston to be disassembled move to its BDC, remove the connecting rod bolt and connecting rod cover; turn the crankshaft to make the piston move to its TDC, use a wooden hammer to knock the piston out of cylinder,



(3) Take care to operate in avoid of connecting rod big end sticking to the cylinder block. Disassemble other pistons in the same way, and place them after ordering.

(4) Squeeze out the front end pulley bolt, and remove the pulley and absorber, etc.

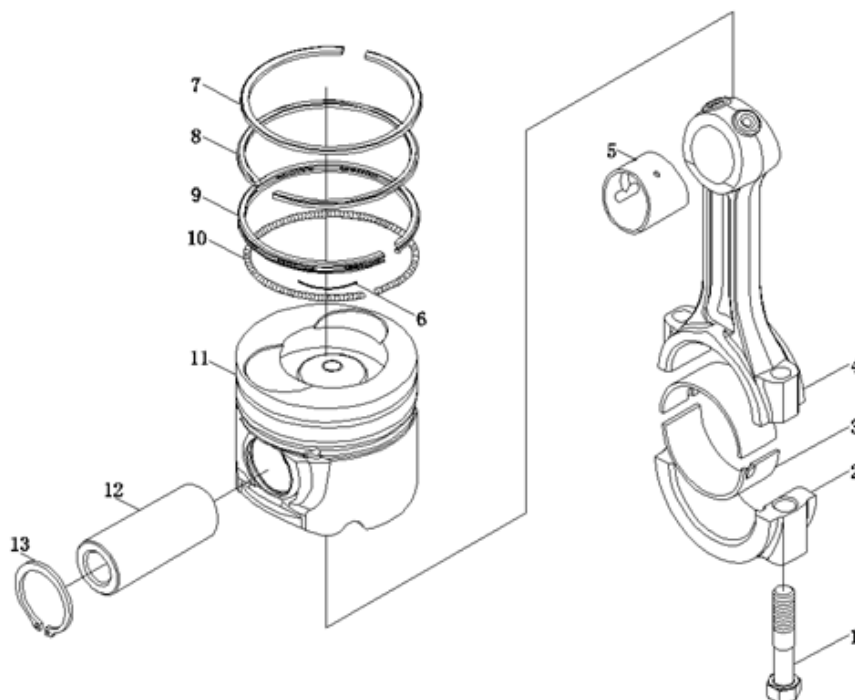
(5) Squeeze out the flywheel bolt, and remove the flywheel assembly, bearing and other parts.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.3.2 Disassembly and Assembly of Piston-Connecting Rod Combination

4.3.2.1 Explosive View of Assembly of Piston-Connecting Rod Combination



1.Connecting rod bolt	2.Connecting rod cover	3. Connecting rod bush
4.Connecting rod body	5.Connecting rod bush	6.Rod bolt
7.First round compression ring	8.Second round compression ring	
9.Oil ring body	10.Spiral support spring	11.Piston
12.Piston pin	13.Retainer ring	

Figure 4-8 Explosive View of Piston-Connecting Rod Combination

4.3.2.2 Disassembly and Assembly of Piston-Connecting Rod Combination

[Disassembly Steps]

(1) Incline the engine and lay it sideways, turn the crankshaft to make the piston to be disassembled move to its BDC, remove the connecting rod bolt and connecting rod cover.

(2) Turn the crankshaft to make the piston move to its TDC, use a wooden hammer to knock the piston out of cylinder, take care to operate in avoid of connecting rod big end sticking to the cylinder block.

(3) Disassemble other pistons in the same way, and place them after ordering.

(4) Use internal circlippliers carefully disassemble elastic retainers on both sides of piston, and push the piston cylinder pin out, remove the connecting rod body. Number the piston cylinder pins and connecting rod bodies respectively, and place them in order.



(5) Use the piston ring installation pliers to disassemble the first round and second round compression ring and the oil ring, and respectively mark them.

[Assembly Steps]

(1) Use internal circlip pliers to assemble an elastic retainer into piston retainer groove, and turn the retainer to make sure it is perfectly installed. The surface with corner angle of retainer should point inwards. Opening of piston cylinder pin retainer should point upwards.

(2) Plug connecting rod small end into inner chamber of piston, and align the connecting rod small end with piston cylinder pin hole, and then install it into piston cylinder pin, finally, install the piston cylinder pin retainer on the other side. And note that the direction of oblique incision of connecting rod is opposite to that of piston cooling oil passage inlet oil hole, before assembly of connecting rod small end hole and piston cylinder pin.

(3) Arrange the piston connecting rod components installed in the order by cylinder number, and then use piston ring installation pliers to install oil ring, the second compression ring and the first compression ring in order into piston groove. The "TOP" surface of piston ring should point upward, and the rings turn flexibly in the groove.

(4) Clean the cylinder face, crankshaft connecting lever and piston connecting rod assembly, and apply clean lubricating oil onto kinematic pairs.

(5) Adjust the direction of ring openings: the opening of the first gaseous ring is located with offset angle of 30° from the center line of piston pin; that of the second ring staggers by 120° from the opening of the first ring; that of the oil ring staggers by 120° respectively from the first and second gaseous rings, and is in the midnormal of center line of piston ring.

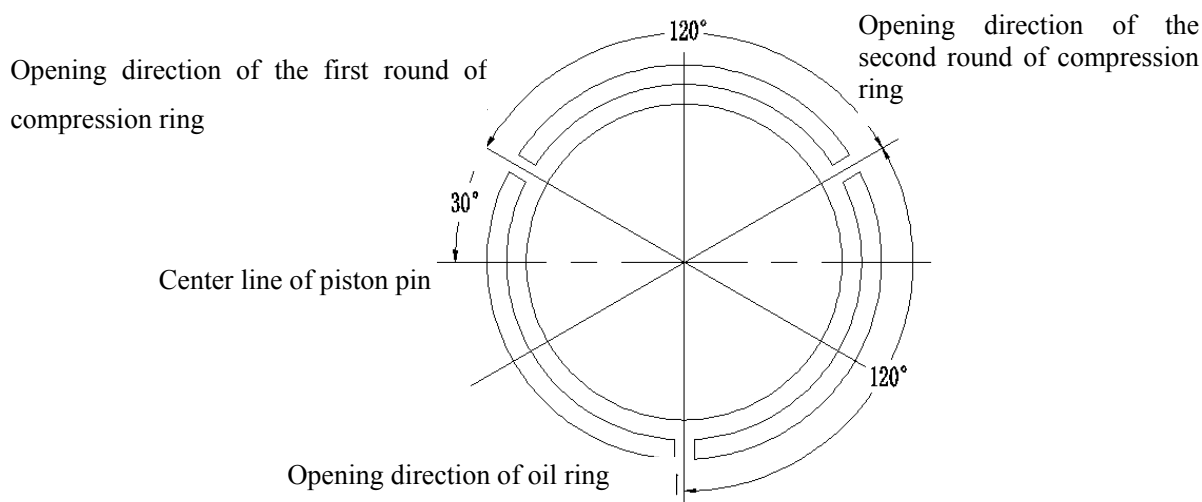


Figure 4-9 Schematic Diagram of Included Angle of Opening of Assembly of Piston Ring

4.3.2.3 Overhaul of Piston-Connecting Rod Combination

(1) Check if there is bur or injury by collision, and check if there is crack, deformation or color change on connecting rod small end.

(2) Mark the cylinder number on one end of connecting rod bolt, and mark the cylinder number on the top of piston which points at flywheel end.

(3) Check if there is bur, oil stain or injury by collision on the piston surface, inner chamber and surface of piston pin.

(4) Piston weight grouping marks of the same engine should be uniform, weight difference between connecting rods of the same engine shall not be larger than 12g.

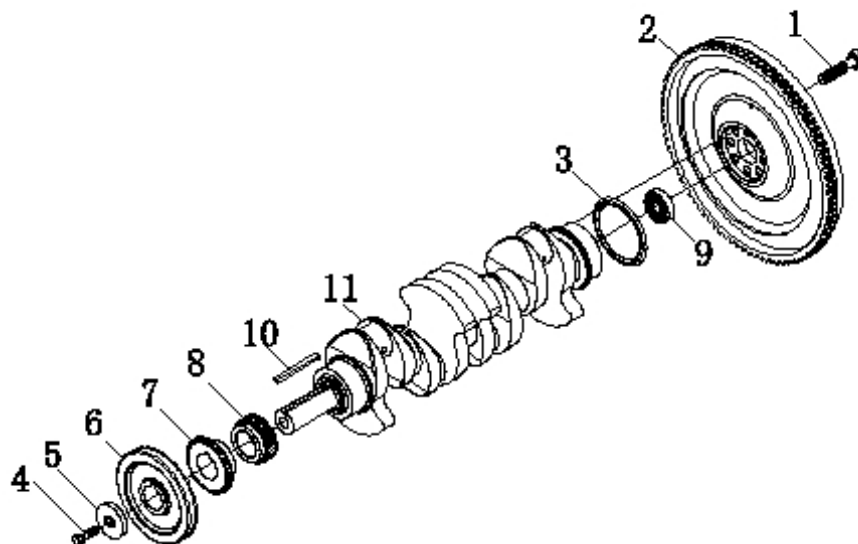
(5) Piston size grouping marks (Roman numerals I and II) and cylinder liner grouping marks (A and B) should be uniform.



(6) The marks on sides of connecting rod and connecting rod cover should be uniform.

4.3.3 Disassembly and Assembly of Crankshaft

4.3.3.1 Explosive View of Assembly of Crankshaft System



1. Flywheel bolt	2. Flywheel ring gear subassembly	3. Rear oil baffle disc	4. Crankshaft pulley bolt
5. Crankshaft pulley pressing plate		6. Crankshaft pulley	7. Oil pump driving gear
8. Crankshaft timing gear	9. Bearing	10. Key	11. Crankshaft

Figure 4-10 Explosive View of Assembly of Crankshaft System

4.3.3.2 Disassembly and Assembly of Crankshaft

[Disassembly Steps]

- (1) Make the main bearing cover point up, remove the main bearing bolts, and place them in order.
- (2) Remove the crankshaft and flywheel, and take out the front and rear thrust plates, and flywheel end bearing. Take out the oil seal; lay the crankshaft on the bracket (if for a very long time, the crankshaft should be laid vertically).
- (3) Sort out and place all the parts disassembled as required.
- (1) Check the bending and deformation of crankshaft.

[Assembly Steps]

- (1) Wipe out the main bearing bottom hole of cylinder block
- (2) Press the upper bearing bush into the bottom hole of cylinder block main bearing in order, and wipe out the foreign matter scratched off the bush.
 - ① Strictly check if there is damage by collision before pressing in the upper bearing bush, if there is damage by bump, and it is not allowed to be used again after repair.
 - ② After being pressed in, the upper bearing bush should align with the oil holes and oil groove in the cylinder block, if staggering by more than 1/5-1/4 of oil holes, assembly of the bush will be prohibited; the upper bearing bush should fit completely with the cylinder block bottom hole.
- (3) Apply adequate clean lubricant to inner surface of upper bearing bush.
- (4) Hoist up the crankshaft, use compressed air to blow out the oil passage holes, and use a towel to wipe out the main journal and connecting rod journal, after that, lightly drop it down into the cylinder block, in this progress, it is required that there should be no crankshaft damage by collision.



- (5) Wipe out the upper thrust plate and press it into cylinder block. Oil groove of upper thrust plate should point outward (pointing at crankshaft).
- (6) Press lower main bearing bush, assemble main bearing cover and lower thrust plate (with oil groove pointing at crankshaft side). There are totally five numbers of main bearing seats, openings for bearing bush location are milled respectively on the main bearing seat and main bearing cover, when assembling main bearing cover, make the boss arrow on the cover point at front end of engine block (See Figure 4-11). All bearing covers and seats are bored in pairs, and marked with corresponding numbers, which should not be exchanged.
- (7) On the basis of ensuring smooth oil seal without distortion or deformation, use special tooling to put the oil seal smoothly into the seal ring groove on the lower plane of cylinder block, when pressing in framework oil seal, make sure it is flat, and ensure the good agreement between cutting edge of oil seal and journal.
- (8) Main bearing bolt: tighten up the main bearing cover with torque wrench in the order below, first, main bearing Number 3, then Number 2 and 4, finally Number 1 and 5, and apply lubrication on the threads and support surface. Two bolts of a same main bearing cover should be tightened up in twice, acquire the torque of 80N.m for the first time, and (140-160) N.m for the second time. Before tightening up the last bolt, move the crankshaft front and back, making the upper and lower thrust plates on the same plane, and then tighten up. Main bearing bolts can be used repeatedly for three times. The tightening order is as shown in the figure below.

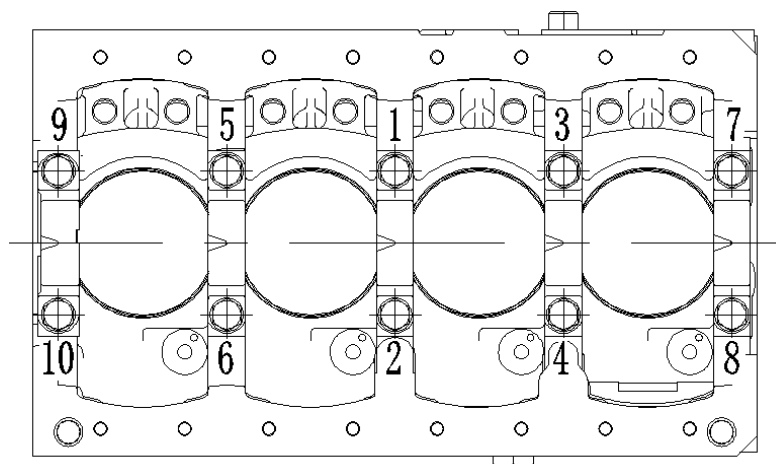


Figure 4-11 Tightening Order of Main Bearing Bolts

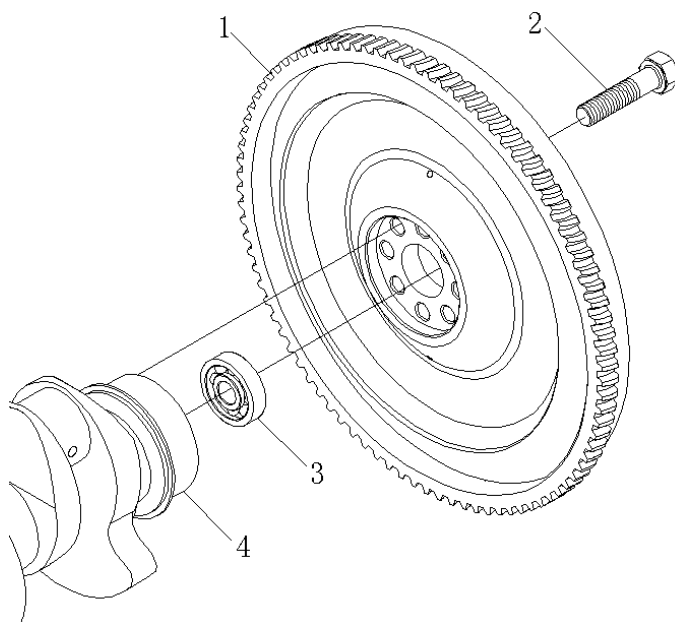
4.3.3.3 Overhaul of Crankshaft

- (1) If there is crack at circular beads of crankshaft main journal and connecting rod neck; for joint between crankshaft and bearing bush, heck and unblock the oil passages to see if there is crack or any other anomaly.
- (2) Check wearing of main journal, connecting rod neck, and check if there is stripe, metal spalling or crack.
- (3) Check wearing at front and rear of crankshaft.
- (4) Check the main bearing bolts for failure modes like thread failure.
- (5) Check if there is main bearing bolt thread damage or any other mode of failure.



4.3.4 Disassembly and Assembly of Flywheel

4.3.4.1 Explosive View of Assembly of Flywheel



1.Flywheel assembly

2.Flywheel bolt

3.Deep groove ball bearing

4.Crankshaft

Figure 4-12 Explosive View of Assembly of Flywheel

4.3.4.2 Disassembly and Assembly of Flywheel

[Disassembly Steps]

- (1) Disassemble the flywheel bolts.
- (2) Remove the flywheel.

[Assembly Steps]

- (1) Knock the deep groove ball bearing into rear end of crankshaft.
- (2) Symmetrically tighten up the flywheel bolts, the tightening order is as shown in the Figure below, and it is necessary to tighten the bolts gradually, the tightening torque at the last time should be 60-70 N·m.

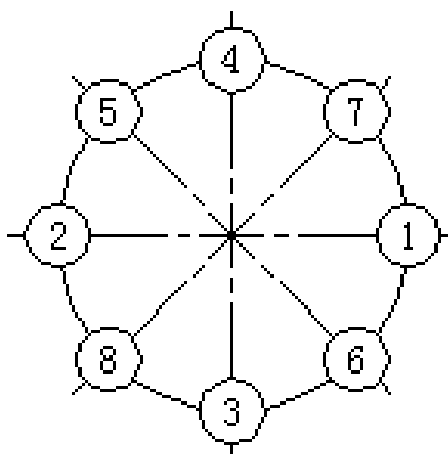


Figure 4-13 Tightening Order of Flywheel Bolts

4.3.4.3 Overhaul of Flywheel

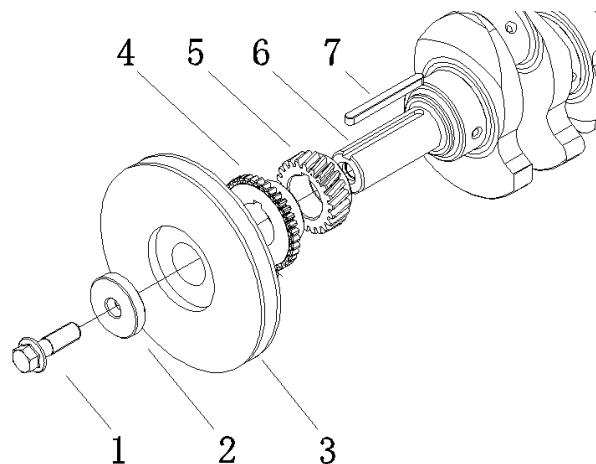
- (1) Check the flywheel bolts for failures like thread failure.



- (2) Check the flywheel surface for bruise.
- (3) Check if the flywheel ring gear is damaged.

4.3.5 Disassembly and Assembly of Crankshaft Pulley

4.3.5.1 Explosive View of Assembly of Crankshaft Pulley



1.Crankshaft pulley bolt	2.Crankshaft pulley pressing plate	3.Crankshaft pulley
4.Oil pump driving gear	5.Crankshaft timing gear	6.Crankshaft
		7.Key

Figure 4-14 Explosive View of Assembly of Crankshaft Pulley

4.3.5.2 Disassembly and Assembly of Crankshaft Pulley

[Disassembly Steps]

Screw down the hexagon bolts, and remove the crankshaft pulley.

[Assembly Steps]

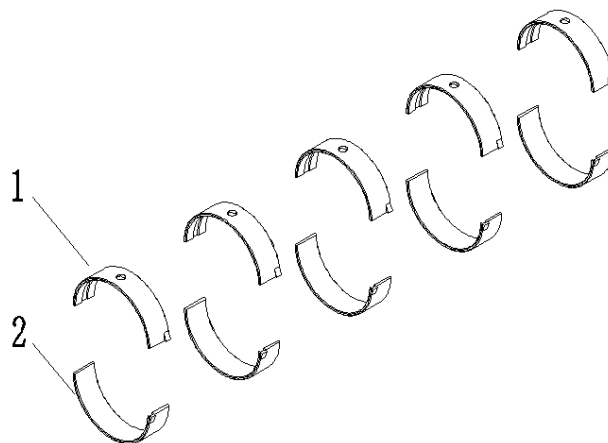
- (1) After assembly of crankshaft timing gear chamber and oil pump gear, assemble the crankshaft pulley.
- (2) Through crankshaft pulley bolts and crankshaft pulley pressing plate, fasten the crankshaft pulley to the front end of crankshaft, tightening torque: (140~160) N·m.

4.3.5.3 Overhaul of Crankshaft Pulley

Check if the crankshaft pulley is damaged, and if there is conquassation at the fastening place of bolts.

4.3.6 Disassembly and Assembly of Crankshaft Bearing Bush

4.3.6.1 Explosive View of Assembly of Crankshaft Bearing Bush



- 1.Upper main bearing bush 2. Lower main bearing bush



Figure 4-15 Explosive View of Assembly of Crankshaft Bearing Bush

4.3.6.2 Disassembly and Assembly of Crankshaft Bearing Bush

[Disassembly Steps]

Take the main bearing bushes from bearing holes, and place them in order in place.

[Assembly Steps]

Operate in the order opposite to assembly steps.

[Note]

(1) There are 5 upper main bearing bushes and lower main bearing bushes respectively, without missing during packing.

(2) Bearing bushes fit with cover and seat, the lug of bearing bush is embedded in the gap of bearing hole.

4.3.6.3 Overhaul of Crankshaft Bearing Bush

Check if the walls of main bearing and main bearing cover plate holes are clean, if not, they must be cleaned up with a clean towel, and the boss on lower main bearing bush should be imbedded into the groove on the main bearing cover plate used for installation of bearing bushes.

4.3.6.4 Assembly Steps of Crankshaft Bearing Bush

(1) Loosen the main bearing cover bolt by hand, remove the main bearing cover, and place them in the order of 1-2-3-4-5.

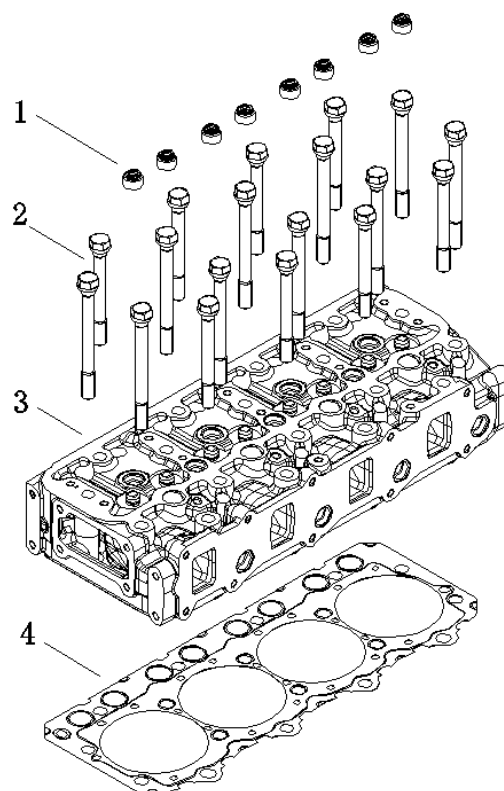
(2) Take 5 lower main bearing bushes (without oil hole), press in the main bearing cover.

(3) Take 5 upper main bearing bushes (with oil hole), press in the engine block.

4.4 Cylinder head combination

4.4.1 Disassembly and Assembly of Cylinder Head Combination

4.4.1.1 Explosive View of Assembly of Cylinder Head Combination



1. Valve oil seal 2. Cylinder head bolt 3. Cylinder head 4. Cylinder head gasket

Figure 4-16 Explosive View of Cylinder Head Combination

4.4.1.2 Disassembly and Assembly of Cylinder Head Combination

[Disassembly Steps]

- (1) Before assembly, make sure the coolants inside the engine has been through the water drain switch, and drained up
- (2) Before disassembly of cylinder head, make sure the parts (such as rocker arm assembly, push rod and so on) of valve system assembled on the cylinder head have been disassembled completely
- (3) Before disassembly of cylinder head, make sure the fuel injector pressing plate bolts have been disassembled completely.
- (4) Before disassembly of cylinder head, make sure the fuel injector assembled on the cylinder head has been disassembled completely, in avoid of injury by collision to the head of fuel injector nipple when placing the cylinder head;
- (5) Loosen the cylinder head bolts in order. Each 4M06 Non-road Stage II Stationary Industrial Power Diesel Engine has 18 cylinder head bolts, in which 10 long bolts, and 8 short bolts. Make sure not to hoist up the cylinder head before all cylinder head bolts are loosened;
- (6) After disassembling cylinder head, put it on a paperboard, template, plastic plate and other low rigidity item in avoid of injury by collision or scratch of bottom plane of cylinder head;
- (7) After disassembling cylinder head, clean the coolant on the top plane of engine block and other impurities to prevent coolant or other impurities from entering into combustion chamber, and causing other faults;
- (8) Disassemble cylinder head gaskets;
- (9) Disassemble air intake and exhaust valves, refer to the disassembling instruction of valve system;
- (10) Disassemble the valve oil seals;

[Check-up]

(1) Cylinder head

Before disassembly of cylinder head, check if there is hint for water leakage, oil leakage or any other abnormal phenomenon, so as to accurately locate the position where problem arises, and correctly analyze the problem.

Clean the cylinder head, particularly the surfaces of combustion chamber, valve seat, intake and exhaust valves and intake and exhaust passage; remove the carbon deposit, viscose, etc. from the surfaces and check the conditions of surfaces.

① Visual inspection

Carefully check for color change and crack of cylinder head, if there is any crack discovered, conduct dye penetrant inspection.

② Deflection of valve

Deflection of Valve is the vertical distance from valve bottom plane to cylinder head bottom plane, and the difference between measured value of deflection of valve and required value of it can indirectly reflects wearing degrees of valve and valve seat. Micrometer depth gauge can be used to measure the deflection of valve, as is shown in Figure 4-17:



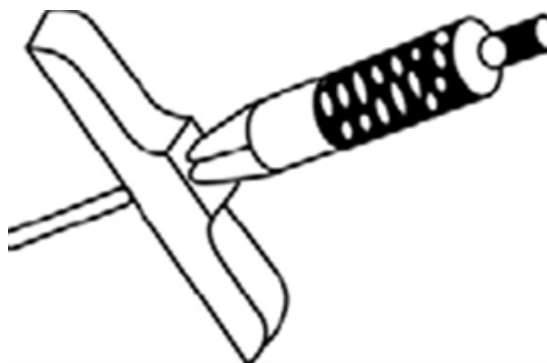


Figure 4-17 Micrometer Depth Gauge

Refer to Table 4-3 for required value of deflection of valve, if deflection of valve still exceeds its required value, it is necessary to replace the cylinder head in order to ensure reliability of engine. If deflection of valve doesn't exceed its allowed value, disassemble valve and check the valve and sealing surface of valve retainer, check if there is obvious wearing or abnormal damage on valve and sealing surface of valve seat.

Table 4-3

	Required value of valve sagging (mm)
Intake valve	0.4 ± 0.1
Exhaust valve	0.4 ± 0.1

③ Valve guide inner diameter

Valve guide inner diameter is the contact surface of moving valve guide and valve, if valve of guide inner diameter exceeds its allowed value because of wearing, the guiding effect of valve will be affected, making working reliability of engine decline. Inside micrometer can be used to measure the size of valve guide inner diameter, as is shown in Figure 4-18. Allowed range of valve guide inner diameter value is: (8~8.022)mm, if it exceeds this range, it is necessary to replace cylinder head in order to ensure working reliability of engine.

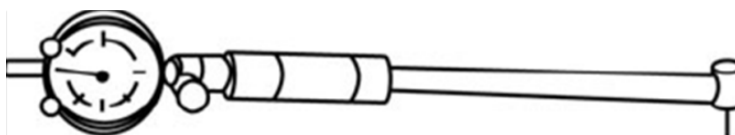


Figure 4-18 Inside Micrometer

(2) Cylinder head gasket

If there is any problem of air leakage, water leakage or oil leakage on cylinder head gaskets, it is necessary to check and replace the cylinder head gaskets.

Disassembly method is as shown in above words on description of disassembly of cylinder head gasket. Check for visible damage of cylinder head gasket and analyze the causes, whether or not there is any problem with cylinder head gasket, any time disassembling it, it is necessary to replace it with a new gasket.

(3) Oil seal of valve

Oil seal of valve is used to ensure the sealing of lubrication at valve rod, at the same time, it also has the function of distributing a certain volume of lubricant uniformly on the valve rod to prevent the dry grinding between valve rod and valve guide pipe from producing cohesion. Before disassembling valve, it is necessary to check if there is fall-off of any oil seal of valve. After disassembling valve, it is necessary to check carefully if the oil seal of valve is intact and if there is crack or aging of it; check if the spring on oil seal of valve is deformed. If corresponding valve and valve guide pipe are seriously worn, replace the oil seals together.

[Assembly Steps]

(1) Oil seal of valve and its assembly are as shown in Figure 4-19.



- ①An oil seal of valve is only allowed to be used for once, if returned for repair, it is required to replace for a new one.
- ②Check if there is defect of oil seal of valve, and if the spring of oil seal of valve is intact.
- ③Install oil seal of valve on valve guide pipe.
- ④Apply lubrication on lip of oil seal of valve.
- ⑤Use installing tools for oil seals of valve and rubber hammer to knock in the oil seals of valve.

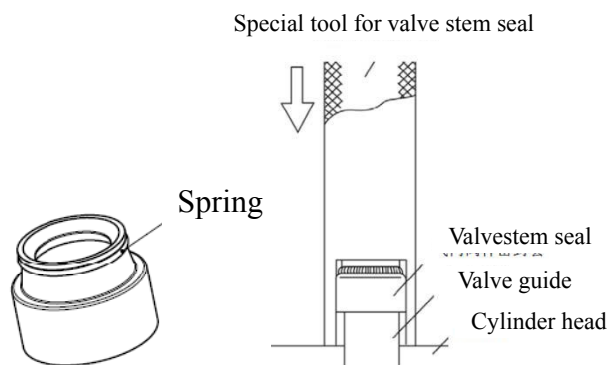


Figure 4-19 Oil Seal

(2) Install the cylinder head gasket

- ①Each cylinder head gasket can only be used for once, if returned for repair, it must be replaced with a new one as is shown in Figure 4-20.
- ②Wipe out the inner wall of cylinder liner, and apply clean lubricant, wipe out the plane on engine block, and put the cylinder head gasket in place according to corresponding cylinder pin holes;
- ③ Check if cylinder head gaskets are correctly assembled.

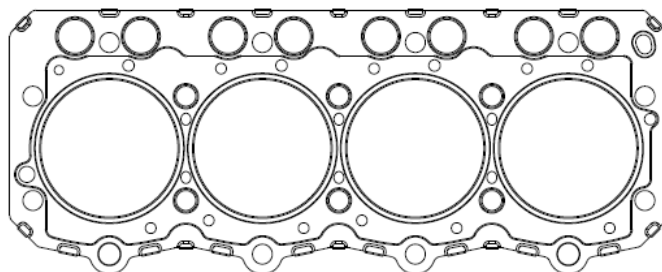


Figure 4-20 Cylinder Head Gasket

(3) Install the cylinder head

- ①Carefully wipe out cylinder head to ensure there is no dust, scraps, sand or any other dirt, and further wipe out the lower plane of cylinder head lower plane.
 - ② Check and confirm there is no foreign matter inside cylinder, and cylinder head gasket and cylinder head lower plane are clean.
 - ③Before tightening the cylinder head bolt, position the cylinder head through cylinder pin-plane.
 - ④Install the cylinder head.
- ## (4) Install the bolts to cylinder heads
- ①Cylinder head bolts are divided into long ones and short ones, as is shown in Figure 4-21.
 - ②Every cylinder head main bolt is allowed to be used for 3 times, tightening order of cylinder head bolts is



as shown in Figure 4-22.

③ Align the cylinder heads in order, after applying lubricants to cylinder head bolt thread and pressure-bearing surface, gradually tighten up in 2-3 times, and the tightening torque for the last time is 95-105N·m, the bolts which cannot acquire the torque should be screwed out, replace them for new ones and retighten up as required.

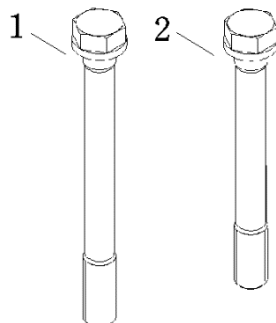


Figure 4-21 Cylinder Head Bolt

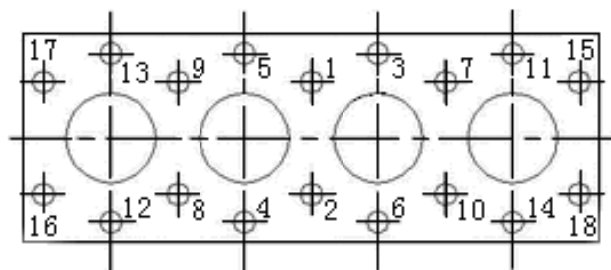
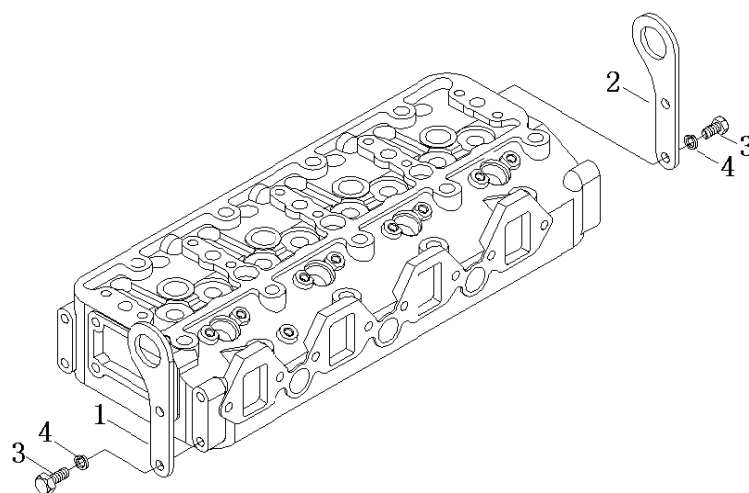


Figure 4-22 Tightening Order

4.4.2 Disassembly and Assembly of Hoisting Rings

4.4.2.1 Explosive View of Assembly of Hoisting Rings



1.Front hoisting ring 2.Rear hoisting ring 3.Hexagon bolt 4.Spring washer

Figure 4-23 Explosive View of Assembly of Hoisting Ring Combination

4.4.2.2 Disassembly and Assembly of Hoisting Rings

[Disassembly Steps]

(1) Loosen the two M8×16 bolts on the front end of engine used for fastening hanger plate (front) of engine, take down the lifting lug (front).

(2) Loosen the two M8×16 bolts on the front end of engine used for fastening hanger plate (rear) of engine,



take down the lifting lug (rear).

[Check-up]

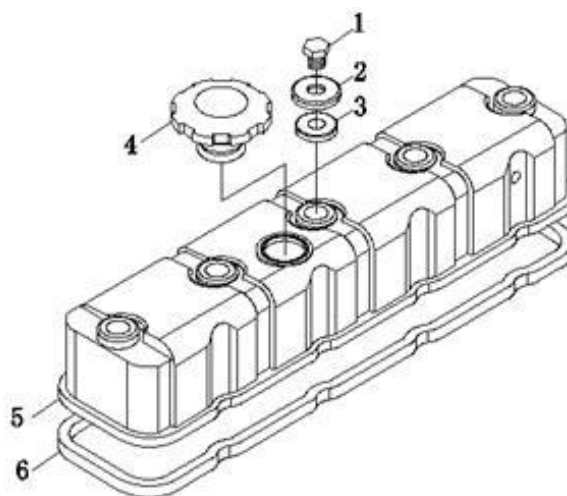
- (1) Check if there is crack or bending on lifting lug of engine.
- (2) Check if the fastening bolts of lifting lug are invalid, please replace for new ones if necessary.

[Assembly Steps]

- (1) Fasten the M8 hexagon flange face bolts on the front and rear hanger plates of engine.
- (2) Assembling positions (front and rear ends of cylinder head) of hanger plates of engine and their fastening bolts are as shown in Figure 4-23.

4.4.3 Disassembly and Assembly of Cylinder Head Cover

4.4.3.1 Explosive View of Disassembly of Cylinder Head Cover



1. Cylinder head cover nut	2. Cylinder head sealing gasket	3. Cylinder head cover sealing cap
4. Oil-filling port plug	5. Cylinder head cover	6. Cylinder head cover gasket

Figure 4-24 Explosive View of Assembly of Cylinder Head Cover

4.4.3.2 Disassembly and Assembly of Cylinder Head Cover

[Disassembly Steps]

- (1) Loosen the gland nuts on the cylinder head cover, cylinder head cover sealing cap, taper washer in order, take out the cylinder head cover and cover seal ring upwards.

[Check-up]

- (1) Before disassembly, it is required to check if there is oil leakage at cover seal ring. If necessary, please check relevant parts carefully.
- (2) Before disassembly, it is required to check if there is oil leakage at cylinder head cover, and if there is crack, damage or any other problem, if necessary, replace for new cylinder head cover.
- (3) Before disassembly, it is required to check if there is oil leakage at oil-filling port. If necessary, please check relevant parts carefully.
- (4) If there is oil leakage at cover seal ring, when disassembling cylinder head cover and cover seal ring, it is required to check if there the cover seal ring is invalid, if there is scratch on the cylinder head cover sealing surface, and if there is large deformation of cylinder head cover sealing surface. If the cover seal ring is, replace for a new one, if the cylinder head cover is largely deformed or there is scratch on it, it is required to replace it.
- (5) If there is oil leakage at oil-filling port, when disassembling oil-filling port cover, check if the oil-filling port thread or sealing gasket is invalid, if there is, replace the oil-filling port cover; if there is scratch on



cylinder head cover and oil-filling port cover, which causes oil leakage, it is required to replace the cylinder head cover.

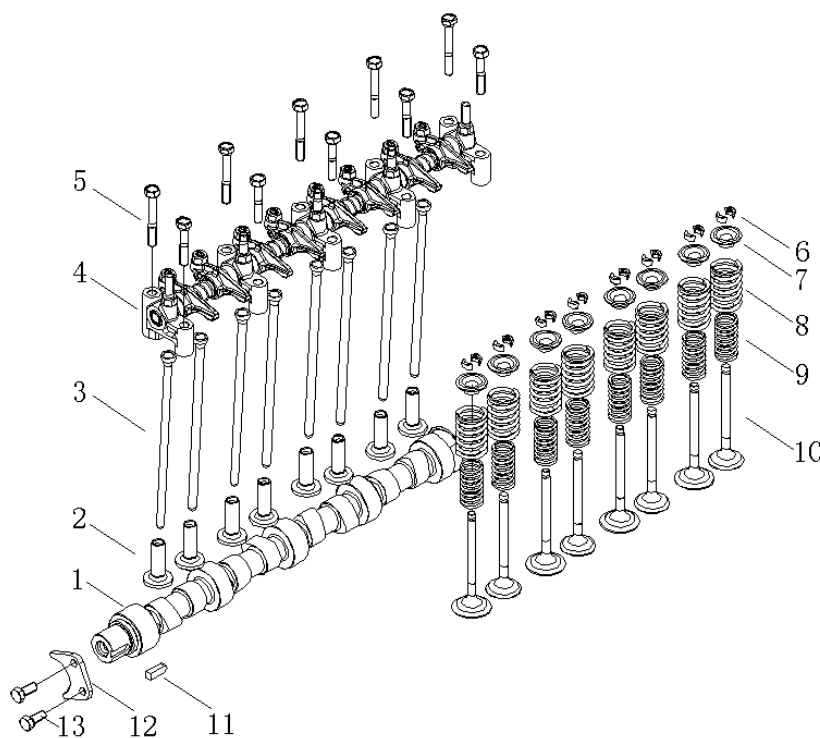
[Assembly Steps]

- (1) Before assembling cylinder head cover seal ring, first check the new cover seal ring to make sure there is no manufacturing defect or damage.
- (2) Clean up the upper surface of cylinder head, and install the cover seal ring correctly.
- (3) Clean up the cylinder head cover, and install it to the cylinder head cover correctly.
- (4) Install the taper washer, cylinder head cover sealing cap and cap-shaped nut, and tighten up the cap-shaped nut.
- (5) Clean up the sealing surfaces corresponding to oil-filling port cover and cylinder head cover, tighten up oil-filling port.

4.5 Valve Mechanism

4.5.1 Disassembly and Assembly of Valve Mechanism

4.5.1.1 Explosive View of Assembly of Valve Mechanism



1. Camshaft	2. Tappet	3. Push rod
4. Rocker arm and rockshaft subassembly	5. Hexagon bolt	6. Valve clamp
7. Upper seat of valve spring	8. Outer spring of valve	9. Inner spring of valve
10. Valve	11. Key	12. Camshaft thrust
13. Hexagon bolt		

Figure 4-25 Explosive View of Assembly of Valve Mechanism

4.5.1.2 Disassembly Steps of Valve Mechanism

- (1) Disassemble rocker arm and Rockshaft subassembly, for more details see Disassembly Steps of Rocker Arm and Rockshaft;
- (2) Disassemble air intake and exhaust valves, for more details see Disassembly Steps of Valves;



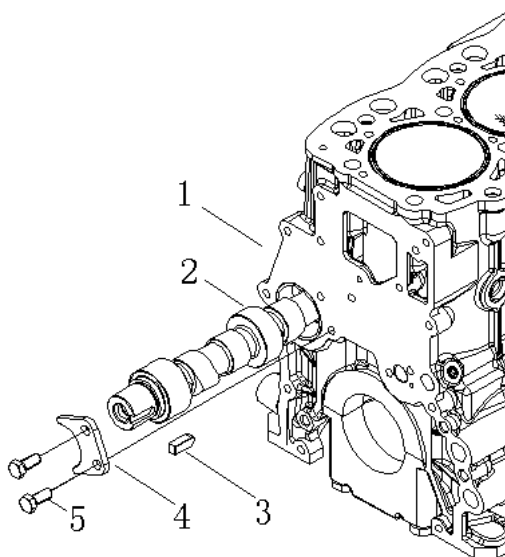
- (3) Disassemble tappet and push rod, for more details see Disassembly Steps of Tappet and Push Rod;
- (4) Disassemble gear train, for more details see Disassembly Steps of Gear Train;
- (5) Disassemble camshaft, for more details see Disassembly Steps of Camshaft.

4.5.1.3 Assembly Steps of Valve Mechanism

- (1) Assemble camshaft, for more details see Assembly Steps of Camshaft.
- (2) Assemble intermediate gear, for more details see Assembly Steps of Intermediate Gear;
- (3) Install the tappet and push rod; see the installation procedure of tappet and push rod for details;
- (4) Install the intake and exhaust valves, see the valve installation procedure for details;
- (5) Assemble rocker arm and rockshaft, for more details see Assembly Steps of Rocker Arm and Rockshaft.

4.5.2 Disassembly and Assembly of Camshaft

4.5.2.1 Explosive View of Assembly of Camshaft



1.Engine block combination 2.Camshaft 3.General flat key 4.Camshaft thrust 5.Hexagon bolt

Figure 4-26 Explosive View of Assembly of Camshaft

4.5.2.2 Disassembly Steps of Camshaft

- (1) Before disassembling gear train, turn camshaft, check if camshaft and timing gear can turn flexibly without clamping stagnation;
- (2) Use a dial indicator to check axial float of camshaft;
- (3) On the workbench of assembly and disassembly of engine, after disassembling push rod-cylinder head assembly, check if there is looseness or any other phenomenon of thrust plate hexagon bolts used for fixing the camshaft on the camshaft, and disassemble camshaft thrust plate, standard elastic washer, and hexagon bolts, and take out the camshaft lightly, preventing from collision of camshaft bearing bush.

4.5.2.3 Overhaul of Camshaft

- (1) Check the cam face in contact with the tappet for wear; check the main journal for seizing and wear;
- (2) Measure lift of camshaft of all cylinders.

4.5.2.4 Assembly Steps of Assembly of Camshaft

After disassembly, check the camshaft, if wearing appears or other parameters have relatively high

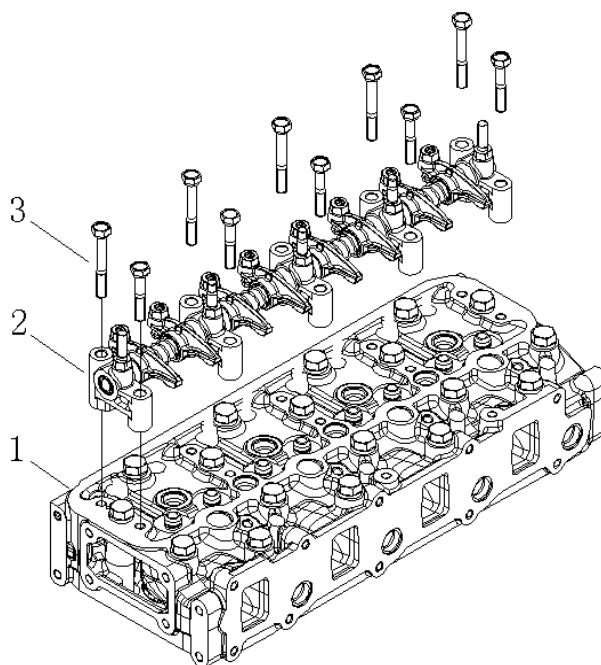


deviation, it is necessary to maintain or replace it with a new camshaft.

- (1) Check if there is bur or injury by collision, and ensure there is no rust, scratch, scrap iron or any other impurity on surface;
- (2) Apply adequate oil to camshaft hole and tappet hole, assemble the tappet, for more details please see the Assembly Steps of Tappet, during assembly of camshaft, push the camshaft with even strength without damaging camshaft surface and engine block hole.
- (3) Assemble the camshaft thrust plate, string the standard elastic washer on the hexagon bolt, and tighten it to the engine block combination through thrust plate hole, seal it after tightening up.
- (4) After tightening up, check the axial clearance of camshaft. If the axial clearance of camshaft is too small, check if there is bur between camshaft and sector plate, if after removing burs, axial clearance of camshaft still cannot be adjusted to above range, replace the camshaft.
- (5) After assembly, turn the crankshaft, and observe if the camshaft can turn flexibly.

4.5.3 Disassembly and Assembly of Rocker Arm and Rockshaft

4.5.3.1 Explosive View of Assembly of Rocker Arm and Rockshaft



1.Cylinder head combination 2.Rocker arm and rockshaft subassembly 3.Hexagon bolt

Figure 4-27 Explosive View of Assembly of Rocker Arm and Rockshaft

4.5.3.2 Disassembly and Assembly of Rocker Arm and Rockshaft

[Assembly Steps]

- (1) Check the assembled parts to make sure they are clean without injury by collision, scratch and rust;
- (2) Lightly put the rocker arm and rockshaft assembly on the cylinder head subassembly, and then put the standard elastic washer on it, loosen the hexagon bolts.
- (3) Tighten up the hexagon bolts, and the tightening order is as shown in Figure 4-28.



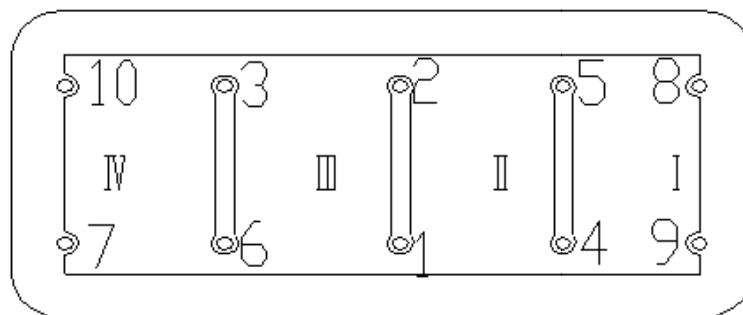


Figure 4-28 Tightening Order

◆ Check and adjust the intake and exhaust valve clearance.

① Turn the crankshaft to make the phase pointer pointing at 0 of phase plate, and observe that Point 0 of crankshaft timing gear meshes with Point 0 of camshaft gear, at this moment, adjust the valve clearances from front end in the order of Rocker Arm 1-2-3-6, adjust the valve clearance: air intake valve 0.35mm, air exhaust valve 0.25mm.

② Return the crankshaft to make the phase pointer pointing at 0 of phase plate, and observe that Point 0 of crankshaft timing gear meshes with Point 180° of Point 0 of camshaft gear, at this moment, adjust the valve clearances from front end in the order of Rocker Arm 4-5-7-8, and the method is the same to ①.

◆ After adjustments, check the valve timing of Cylinder 1 in cold-state:

Air intake valve opens at 16° before TDC; air intake valve closes at 42° after BDC;

Air exhaust valve opens at 60° before BDC; air exhaust valve closes at 10° after TDC.

[Disassembly Steps]

The disassembly steps are opposite to the assembly steps.

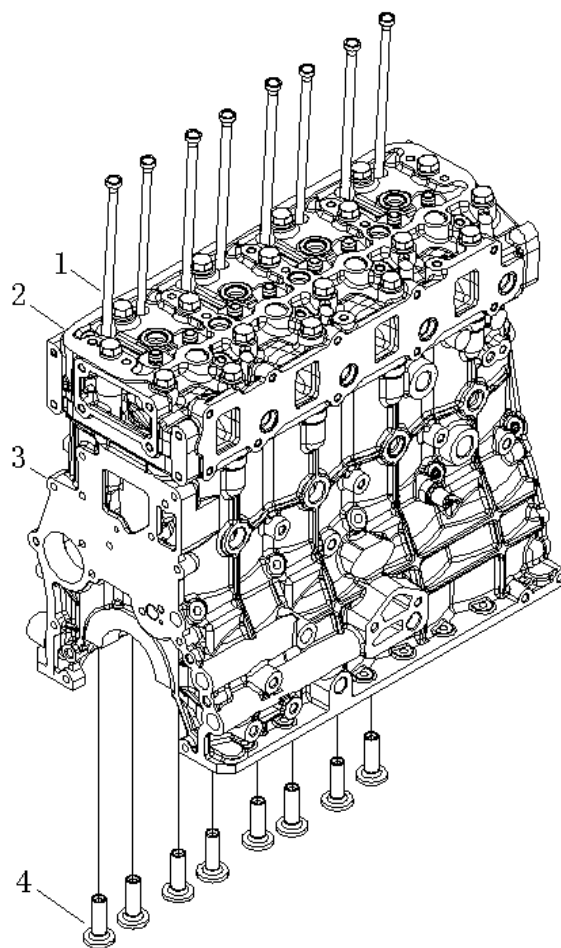
4.5.3.3 Overhaul of Rocker Arm and Rockshaft

- (1) Clean the rocker, and check its appearance for defects like cracks.
- (2) Check the rocker bore for wear and bruise, and measure its diameter.
- (3) Check if there is wearing on rocker arm adjusting screw and arc surface on the other side of rocker arm.
- (4) Check if various oil galleries are blocked.
- (5) Measure the diameters of the rocker hole and rockshaft, and calculate the fit clearance.



4.5.4 Disassembly and Assembly of Tappet and Push Rod

4.5.4.1 Explosive View of Assembly of Tappet and Push Rod



1.Push rod 2.Cylinder head 3.Engine block 4.Tappet

Figure 4-29 Explosive View of Assembly of Tappet and Push Rod

4.5.4.2 Disassembly Steps of Tappet and Push Rod

- (1) After disassembly of rocker arm and rockshaft, directly take out the push rods, and place them in order;
- (2) After disassembly of camshaft, take out the tappets from downside of engine block, and place them in order.

4.5.4.3 Overhaul of Tappet and Push Rod

- (1) Clean up the push rod and tappet;
- (2) Check if the oil passages of tappet and push rod are unblocked;
- (3) Check if there is bending of push rod, and check the degree of wearing on external surface;
- (4) Check if there is wearing at ball end and concave end of push rod;
- (5) Check if there is wearing on surface or bottom surface of tappet;
- (6) Check if there is wearing on internal concave end of tappet.

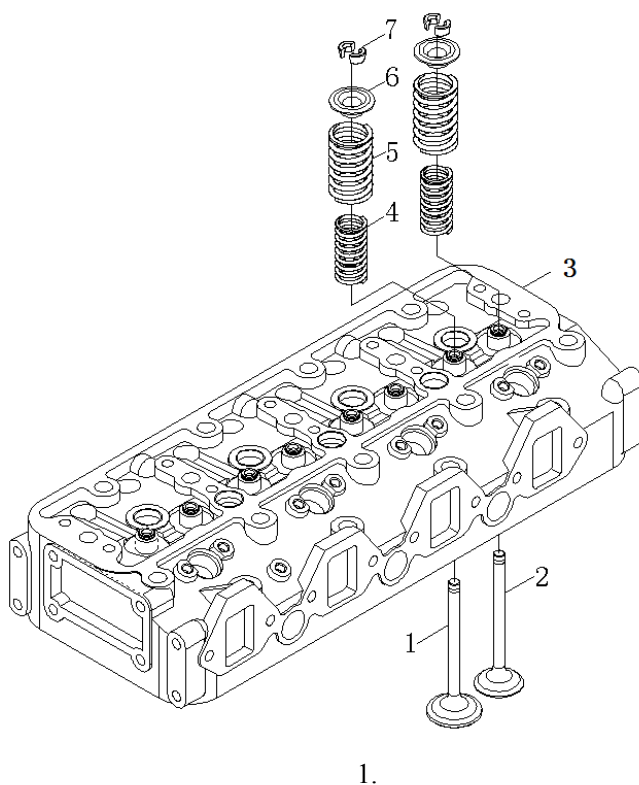


4.5.4.4 Assembly steps of Tappet and Push Rod

- (1) Check if there is any problem with tappet or push rod, if so, replace it. Before assembling the tappet, it must be blown off with compressed air, and check if the oil hole is unblocked;
- (2) Apply lubrication on engine block tappet hole and outer circle of valve tappet, evenly;
- (3) Put the tappet into tappet hole from the downside of engine block lightly, make sure tappet can rotate freely in the tappet hole, and the resistance can be felt even by hand. Assemble the camshaft, for more details see Assembly Steps of Camshaft;
- (4) Assemble rocker arm seat to cylinder head, and check if the push rod is clean, and welding is in good condition;
- (5) Apply clean lubricant to push rod, and ensure there is sufficient lubricant on bulb;
- (6) Assemble the push rod, and penetrate the push rod lightly through the cylinder head into the tappet.

4.5.5 Disassembly and Assembly of Valves

4.4.5.1 Explosive View of Assembly of Valves



1. Air intake valve	2. Air exhaust valve	3. Cylinder head
4. Inner valve spring	5. Outer valve spring	6. Upper seat of valve spring
7. Valve lock clamp		

Figure 4-30 Explosive View of Assembly of Valves

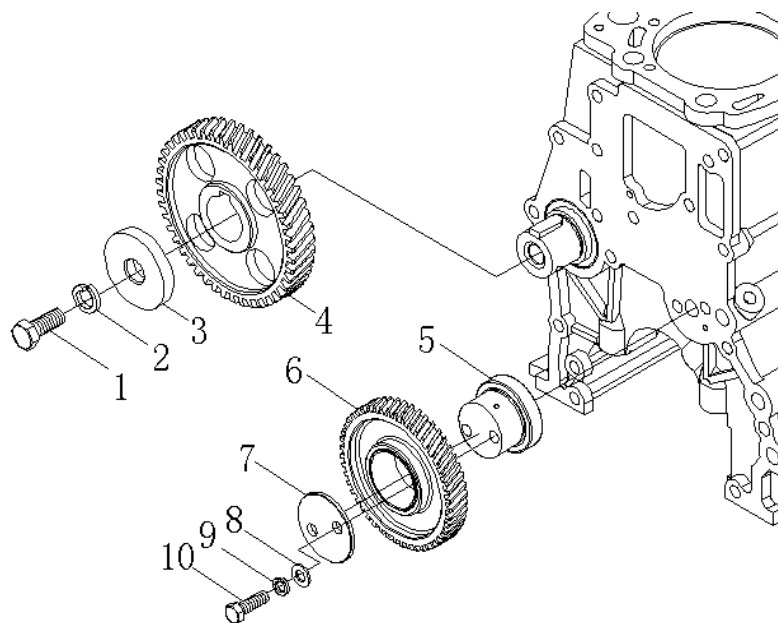
4.5.5.2 Disassembly Steps of Valves

- (1) Use a valve spring compressor or valve overhead pliers or any other tool to press down the valve spring, and take out the valve lock clamp, take down the valve spring upper seat and inner and outer valve springs
- (2) Take the valve out of valve seat.



4.5.6 Disassembly and Assembly of Gear Train

4.5.6.1 Explosive View of Assembly of Gear Train



1.

1.Hexagon bolt	2.Spring washer	3.Camshaft gear pressing plate	4.Camshaft gear
5.Intermediate gear shaft		6.Intermediate gear assembly	
7.Intermediate gear pressing plate		8.Flat washer	9.Spring washer
10.Hexagon bolt			

Figure 4-31 Explosive View of Assembly of Gear Train

4.5.6.2 Disassembly and Assembly of Gear Train

- (1) Disassemble fuel injection pump, for more details see Disassembling Instructions for Fuel System;
- (2) Turn camshaft, check if camshaft assembly and camshaft timing gear turn flexibly without clamping stagnation;
- (3) Check with a dial gage the camshaft for axial float, as compared with before;
- (4) Check backlash between the timing gear and intermediate gear of camshaft, and backlash between intermediate gear and crankshaft timing gear;
- (5) Check if there is looseness or any other phenomenon on camshaft gear pressing plate bolts, disassemble the camshaft gear pressing plate bolts, and disassemble camshaft timing gear;
- (6) Check intermediate gear installation bolt mark to confirm if the bolt turns. Disassemble 2 hexagon bolts of intermediate gear, and remove the gaskets, remove the intermediate gear, and take remove the intermediated gear shaft.

4.5.6.3 Overhaul of Gear Train

- (1) Check if thread of bolt installed is in good condition;
- (2) If there is tooth surface spalling or broken tooth of gear, if there is crushing on bolt bearing surface, if there is deformation on the thread hole or through-hole on the gear;
- (3) Check if there is abnormal wearing between the intermediate gear shaft and intermediate gear bush. If oil holes are blocked by dirty foreign matters.



4.6 Air Intake and Exhaust System

4.6.1 Disassembly and Assembly of Air Intake and Exhaust System

[Disassembly Steps]

(1) Disassemble the air intake manifold, for more details see Disassembly and Assembly Steps of Air Intake Manifold.

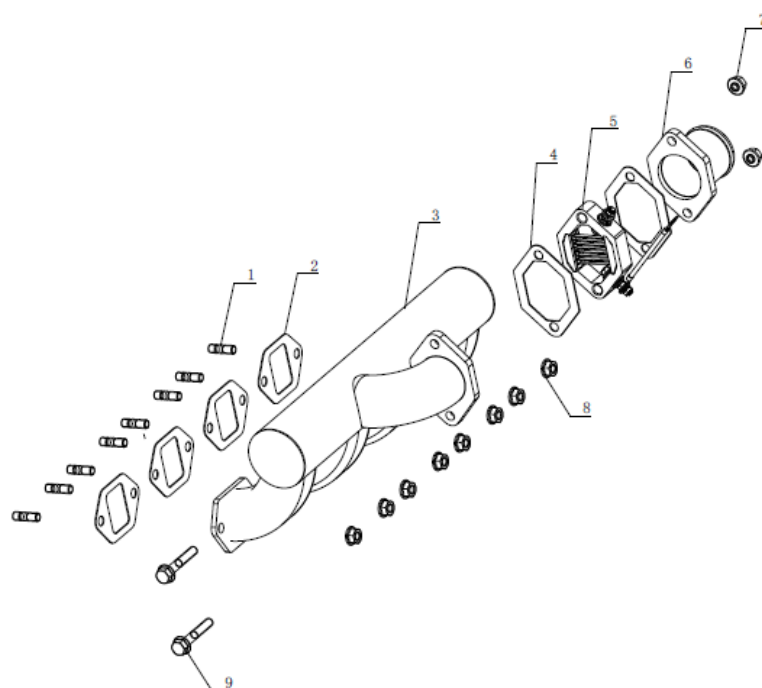
(2) Disassemble the exhaust manifold, for more details see Disassembly and Assembly Steps of Exhaust Manifold.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.6.2 Disassembly and Assembly of Air Intake Manifold

4.6.2.1 Explosive View of Assembly of Air Intake Manifold



1.Stud	2.Intake manifold gasket	3.Intake manifold	4.Intake manifold gasket
5.Heater	6.Intake connecting pipe	7.Hexagon flange face nut	8.Hexagon flange face nut
9.Hexagon flange face bolt			

Figure 4-32 Explosive View of Assembly of Air Intake Manifold

4.6.2.2 Disassembly and Assembly of Air Intake Manifold

[Disassembly Steps]

- (1) Loosen the nuts of air intake connecting pipe.
- (2) Remove air intake connecting pipe, heater and gaskets.
- (3) Loosen the nuts of air intake manifold.
- (4) Remove air intake manifold and gasket.

[Check-up]

Check if there is crack, deformation or any other damage on the air intake manifold body, if there is, it is

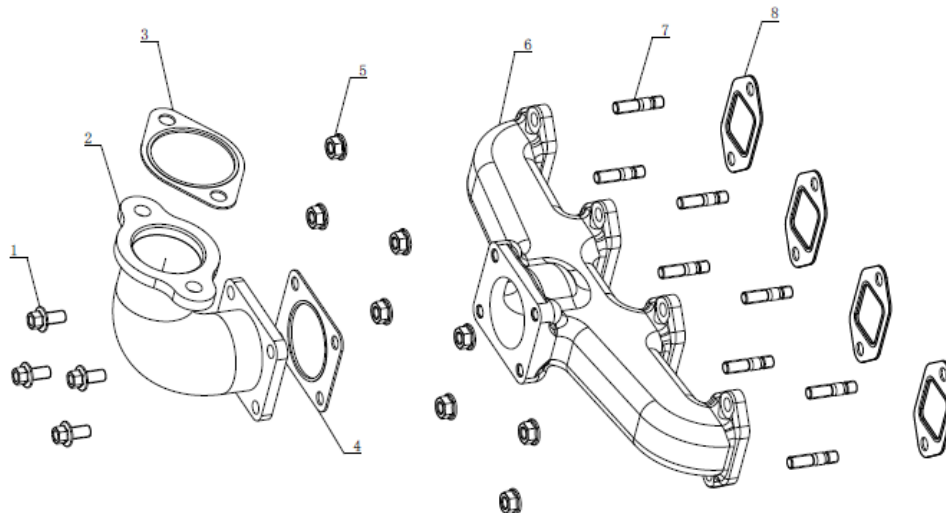


necessary to replace it with a new air intake manifold.

[Assembly Steps] Assembly steps are opposite to disassembly steps.

4.6.3 Disassembly and Assembly of Air Exhaust Manifold

4.6.3.1 Explosive View of Assembly of Air Exhaust Manifold



1.Hexagon flange face bolt	2.Air exhaust connecting pipe	3.Exhaust manifold gasket	4.Gasket
5.Hexagon flange face nut	6.Exhaust pipe	7.Stud	8.Gasket

Figure 4-33 Explosive View of Assembly of Exhaust Manifold

4.6.3.2 Disassembly and Assembly of Exhaust Manifold Combination

[DisassemblySteps]

- (1) Loosen the bolts of exhaust connecting pipe, remove the air exhaust connecting pipes and gasket.
- (2) Loosen the bolts of exhaust manifold, remove the exhaust manifold and gasket.

[Check-up]

- (1) Check if there is crack or any other damage on the exhaust manifold body, and if there is deformation of flange, if there is, it is necessary to replace it with a new exhaust manifold.
- (2) Check if there is air leakage at the exhaust manifold flange, and if there is, it is necessary to replace for new exhaust manifold gaskets.
- (3) Check if there is deformation, tear, missing or any other situation on the exhaust manifold, if there is, it is necessary to replace for new ones.
- (4) Check if there is sintering, rust, carbon deposit or any other problem on the exhaust manifold, if there is, replace them.

[Assembly Steps] Assembly steps are opposite to disassembly steps.

4.7 Fuel System

4.7.1 Disassembly and Assembly of Fuel System

[Disassembly Steps]

- (1) Disassemble high-pressure oil pipe, for more details see Disassembly and Assembly of High-pressure Fuel Pipe.
- (2) Disassemble low-pressure oil pipe, for more details see Disassembly and Assembly of Low-pressure



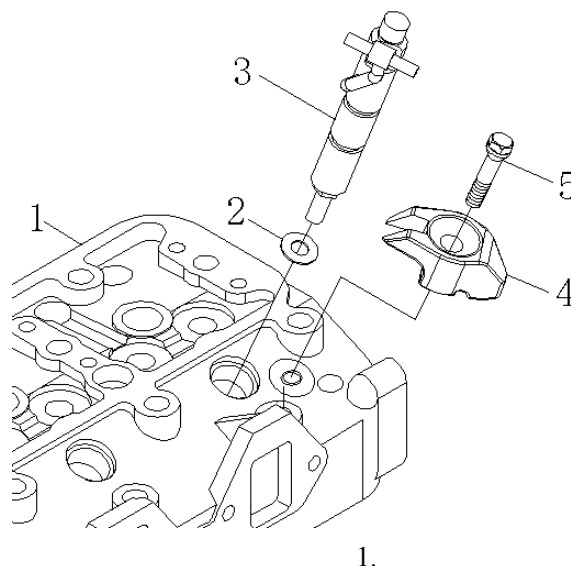
(2) Align fuel injection pump mint-mark with its corresponding mint-mark.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.7.3 Disassembly and Assembly of Fuel Injector

4.7.3.1 Explosive View of Assembly of Fuel Injector



1. Cylinder head 2. Fuel injector adjusting gasket 3. Fuel injector 4. Fuel injector pressing plate
5. Fuel injector pressing plate bolt

Figure 4-35 Explosive View of Assembly of Fuel Injector

4.7.3.2 Disassembly and Assembly of Fuel Injector

[Disassembly Steps]

- (1) Disassemble injection pump oil return pipes on fuel injectors of all cylinders;
- (2) Disassemble fuel injector pressing block fastening bolts, and remove the fuel injector pressing block.
- (3) Use special tooling to remove the fuel injector from cylinder head.

[Check-up]

- (1) Check the copper sealing washer, if there is overlarge deformation or other damage, it is necessary to replace it, at the same time, clean fuel injector seal hole surface, remove carbon deposit or any other impurity on it to ensure sealing; do not make mistakes when assembling the fuel injector, sealing washer and the adjusting gaskets on it, so that the extension length of lower conical surface and top end of throttle body can meet the requirements.
- (2) Check if there is damage or leakage on appearance of fuel injector oil return pipe, if there is, it is necessary to replace it.

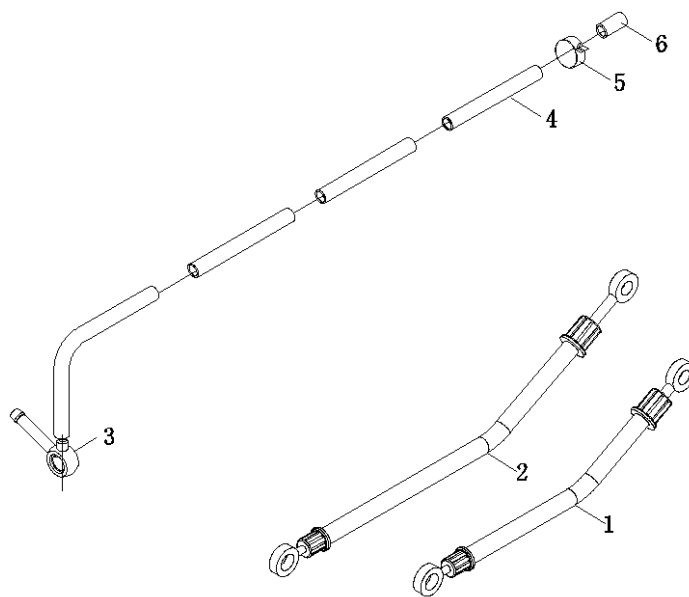
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.7.4 Disassembly and Assembly of Low-pressure Fuel Pipe

4.7.4.1 Explosive View of Assembly of Low-pressure Fuel Pipe



1. Fuel injection pump fuel inlet pipe	2. Fuel delivery pump fuel outlet pipe	3. Welding of fuel pipe
4. Fuel injector fuel return pipe	5. Clamp	6. Injector fuel return pipe plug

Figure 4-36 Explosive View of Assembly of Low-pressure Fuel Pipe

4.7.4.2 Disassembly and Assembly of Low-pressure Fuel Pipe

[Disassembly Steps]

- (1) Disassemble the bolts fixing fuel pipe clamps and the clamps;
- (2) Loosen the hollow bolts and hose clamps at end of fuel pipe;
- (3) Disassemble all low-pressure pipeline in order.

[Check-up]

- (1) Check if there is fuel leakage on appearances of low-pressure fuel pipe. If there is, it is necessary to replace it and feedback to manufacturer through corresponding procedures;
- (2) Check if there is fuel leakage at connecting ports on both ends of low-pressure fuel pipe, if there is, it is necessary to replace the hollow bolt sealing washer.

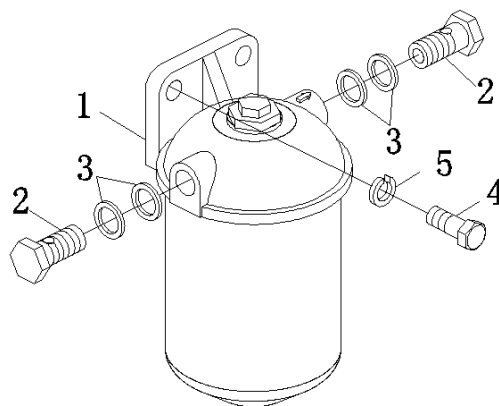
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.7.5 Disassembly and Assembly of Fuel Filter

4.7.5.1 Explosive View of Assembly of Fuel Filter



1.Fuel filter

2.Hollow bolt

3.Washer

4.Hexagon bolt

5.Spring washer

Figure 4-37 Explosive View of Assembly of Fuel Filter Combination

4.7.5.2 Disassembly and Assembly of Fuel Filter

[Disassembly Steps]

- (1) Disassemble the two bolts fixing the fuel filter;
- (2) Disassemble the fuel filter.

[Check-up]

- (1) Check if the appearances of fuel filter is intact;
- (2) Check if there is fuel leakage at junction of fuel filter and filter seat, if there is, it is necessary to replace the parts that affect;
- (3) Check if there is blockage of fuel filter, if there is, replace the filter elements. When replacing filter elements, when removing the filter elements, it is required to fill up the new filter elements with clean diesel, at the same time, keep the base seat of filter seat clean and apply lubricant on the rubber pad; After the rubber pad contacts with seat, tighten again by 3/4~1 round to make it sealed; At last, it is required to disassemble the bleeder screw on the filter seat, press the hand pump on coarse filter to bleed air in the filter.

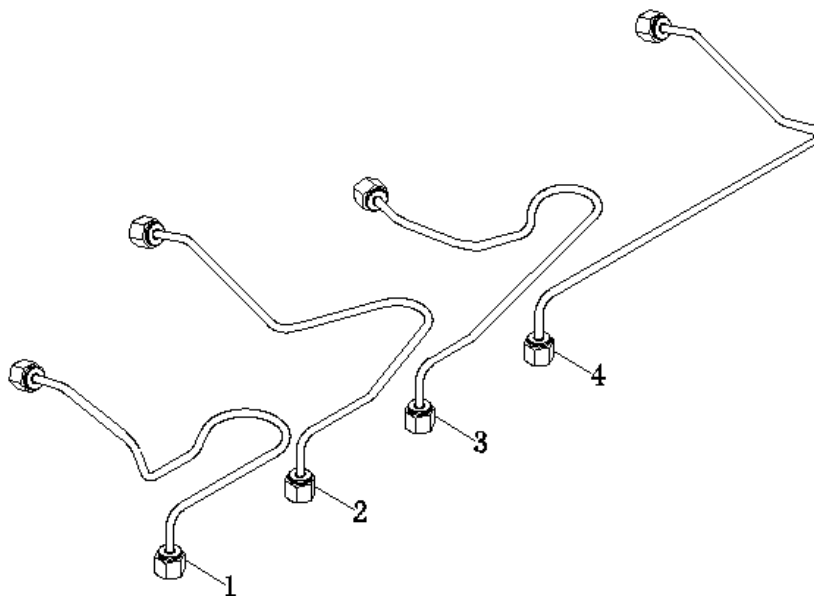
[Assembly Steps]

Assembly steps are opposite to disassembly steps. But note that when replacing filter elements, it is required to fill up the new filter elements with clean diesel, at the same time, keep the base seat of filter seat clean and apply lubricant on the rubber pad; after the rubber pad contacts with seat, tighten again by 3/4~1 round to make it sealed; At last, it is required to disassemble the bleeder screw on the filter seat, press the hand pump on coarse filter to bleed air in the filter.



4.7.6 Disassembly and Assembly of High-pressure Fuel Pipe

4.7.6.1 Explosive View of Assembly of High-pressure Fuel Pipe



1.High-pressure fuel pipe of Cylinder 1

2.High-pressure fuel pipe of Cylinder 2

3.High-pressure fuel pipe of Cylinder 3

4.High-pressure fuel pipe of Cylinder 4

Figure 4-38 Explosive View of Assembly of High-pressure Fuel Pipe Combination

4.7.6.2 Disassembly and Assembly of High-pressure Fuel Pipe

[Disassembly Steps]

- (1) Disassemble the nut connecting the high-pressure fuel pipe and pump;
- (2) Disassemble the nut connecting the high-pressure fuel pipe and fuel injector;

[Check-up]

- (1) Check if there is fuel leakage on appearances of high-pressure fuel pipe. If there is, it is necessary to replace it;

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.8 Cooling System

4.8.1 Disassembly and Assembly of Cooling System

[Disassembly Steps]

- (1) Disassemble fan, for more details see Disassembly and Assembly of Fan.
- (2) Disassemble water pump, for more details see Disassembly and Assembly of Water Pump.
- (3) Disassemble water drain valve, for more details see Disassembly and Assembly of Water Drain Valve.
- (4) Disassemble thermostat, for more details see Disassembly and Assembly of Thermostat.
- (5) Disassemble front end cover plate, for more details see Disassembly and Assembly of Front End Cover Plate.

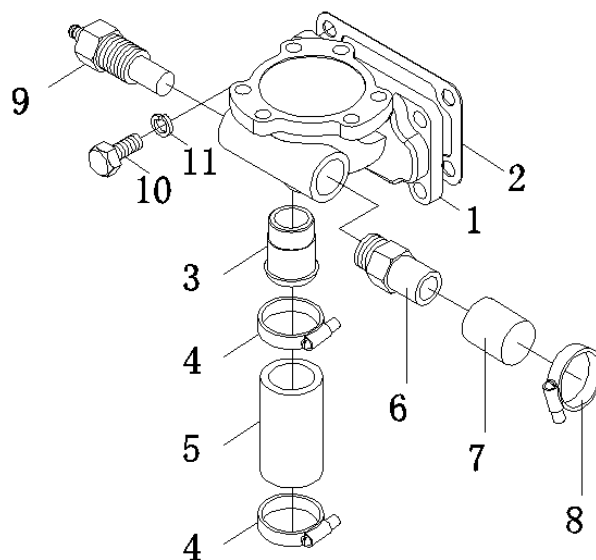
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.8.2 Disassembly and Assembly of Front End Cover Plate

4.8.2.1 Explosive View of Assembly of Front End Cover Plate



1.Front end cover plate	2.Front end cover gasket	3.Tube connector	4.Clamp
5.Rubber tube	6.Heater connector	7.Rubber tube	8.Clamp
9.Water temperature plug sensor	10.Hexagon bolt	11.Spring washer	

Figure 4-39 Explosive View of Assembly of Front End Cover Plate

4.8.2.2 Disassembly and Assembly of Front End Cover Plate

[Disassembly Steps]

- (1) Loosen the four bolts in order, and remove the gaskets;
- (2) Remove the heater connector and screw plug in order, and classify and put away the flange face bolt.

[Check-up]

- (1) Check the gaskets, if there is impression or any other problem, it is necessary to replace the gaskets;
- (2) Check the front end cover plates, if there is crack or any other problem, replace for new ones;

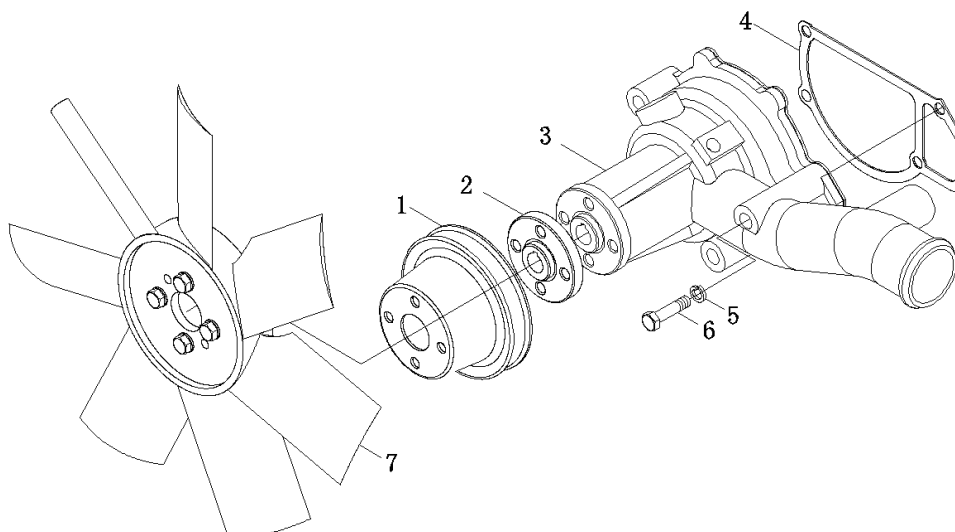
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.8.3 Disassembly and Assembly of Water Pump

4.8.3.1 Explosive View of Assembly of Water Pump



1. Water pump pulley 2. Spacer Block 3. Water pump 4. Gasket 5. Spring washer 6. Hexagon bolt 7. Fan

Figure 4-40 Explosive View of Assembly of Water Pump

4.8.3.2 Disassembly and Assembly of Water Pump

[Disassembly Steps]

- (1) Remove the fan combination, for more details see Disassembly Steps of Fan Combination;
- (2) Remove the water pump pulley and intermediate spacer block;
- (3) Move upward the water pipe connector by a certain displacement.
- (4) Loose the four flange face bolts in order, at the same time remove the water pump and spacer block;
- (5) Classify and put away all the parts.

[Check-up]

- (1) Check if the gaskets are intact, if there is impression or any other problem, it is necessary to replace for new water pump gaskets;
- (2) Check the O-ring, make sure there is no crack or any other problem, or else, it is necessary to replace for a new one;
- (3) Check the water pump, make sure the water pump can run flexibly without stagnation, or else, replace for new water pump;
- (4) Check the water pipe connector, and make sure there is no bur or any other problem, or else, replace for a new water pipe connector.

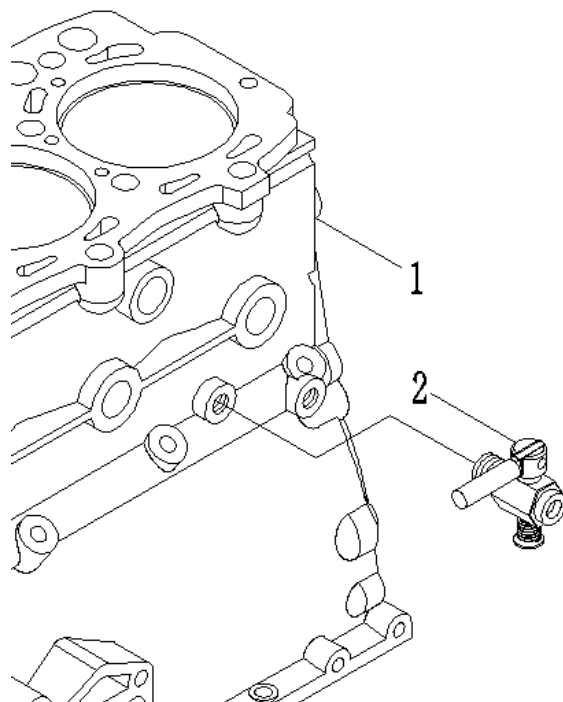
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.8.4 Disassembly and Assembly of Water Drain Valve

4.8.4.1 Explosive View of Assembly of Water Drain Valve



1. Engine block 2. Water drain valve

Figure 4-42 Explosive View of Assembly of Water Drain Valve

4.8.4.2 Disassembly and Assembly of Water Drain Valve

[Disassembly Steps]

- (1) Loosen the clamp, and remove it and water outlet pipe;
- (2) Remove the water drain switch assembly from engine block;

[Check-up]

- (1) Check if there is leakage of water outlet pipe, if there is, replace for a new one;
- (2) Check if there is scratch or any other problem with the water drain switch connecting thread, if there is, replace for a new water drain switch.

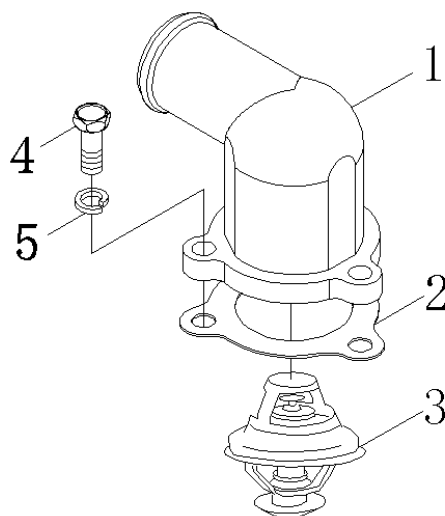
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.8.5 Disassembly and Assembly of Thermostat

4.8.5.1 Explosive View of Assembly of Thermostat



1.Thermostat cover 2.Thermostat cover gasket 3.Thermostat 4.Bolt 5.Spring washer

Figure 4-42 Explosive View of Assembly of Thermostat

4.8.5.2 Disassembly and Assembly of Thermostat

[Disassembly Steps]

Loosen the three flange face bolts in order, and remove the gasket, thermostat cover and thermostat respectively.

[Check-up]

- (1) Check if the gaskets are intact, if there is impression or any other problem, it is necessary to replace for new gaskets;
- (2) Check if there is scratch or any other problem with the bolt connecting thread, if there is, replace for new bolts.

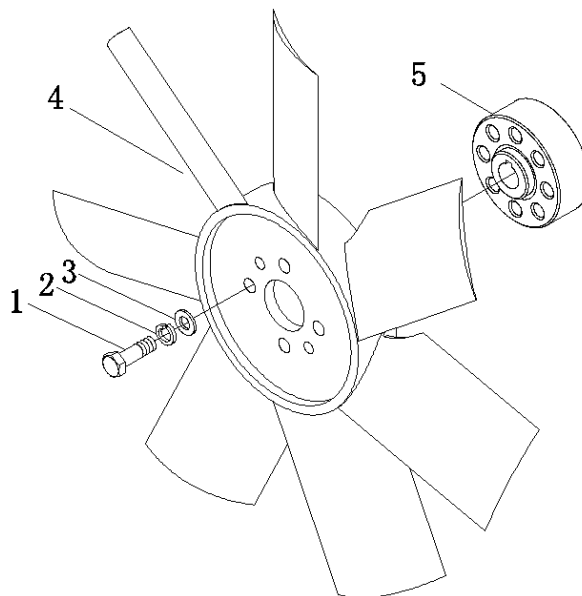
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.8.6 Disassembly and Assembly of Fan

4.8.6.1 Explosive View of Assembly of Fan



1. Bolt 2.Spring washer 3.Flat washer 4.Fan 5.Spacer block

Figure 4-43 Explosive View of Assembly of Fan

4.8.6.2 Disassembly and Assembly of Fan

[Disassembly Steps]

Loosen the four flange face bolts in order, and remove the fan and intermediate spacer block respectively.

[Check-up]

Check if there is scratch or any other problem with the bolt connecting thread, if there is, replace for new bolts.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.9 Lubrication System

4.9.1 Disassembly and Assembly of Lubrication System

[Disassembly Steps]

- (1) Disassemble oil cooler and filter, for more details see Disassembly and Assembly of Oil Cooler and Filter.
- (2) Disassemble the dipstick, for more details see Disassembly and Assembly of Dipstick.
- (3) Disassemble the oil strainer, for more details see Disassembly and Assembly of Oil Strainer

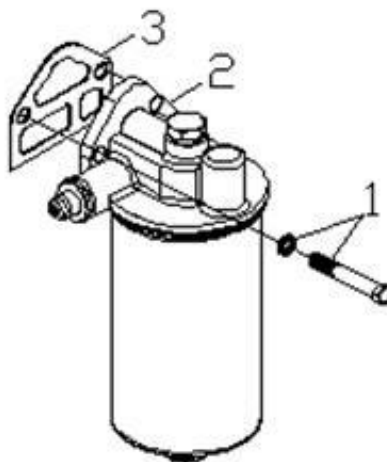
[Assembly Steps]

Assembly steps are opposite to disassembly steps.



4.9.2 Disassembly and Assembly of Oil Cooler and Filter

4.9.2.1 Explosive View of Assembly of Oil Cooler and Filter



1. Bolt and washer 2.Oil filter 3.Oil filter gasket

Figure 4-44 Explosive View of Assembly of Oil Cooler and Filter

4.9.2.2 Disassembly and Assembly of Oil Cooler and Filter

[Disassembly Steps]

Loosen the two flange face bolts in order, and remove the gaskets and oil cooler and filter assembly.

[Check-up]

(1) Check if the gaskets are intact, if there is impression or any other problem, it is necessary to replace for new gaskets;

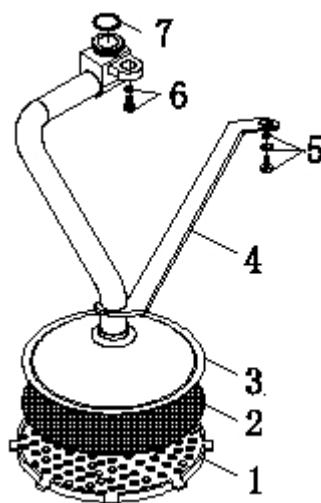
(1) Check if there is scratch or any other problem with the bolt connecting thread, if there is, replace for new bolts.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

4.9.3 Disassembly and Assembly of Oil Strainer

4.9.3.1 Explosive View of Assembly of Oil Strainer



1.Lower part of oil strainer	2.Filter screen	3.Welding of upper part of oil strainer
4.Oil sucking pipe hoisting lug	5.Bolt and washer	6.Bolt and washer
7.O-ring		

Figure 4-45 Explosive View of Assembly of Oil Strainer

4.9.3.2 Disassembly and Assembly of Oil Strainer

[Disassembly Steps]

- (1) Disassemble the oil sump.
- (2) Disassemble the 3 installation hexagon flange bolts.

[Assembly Steps]

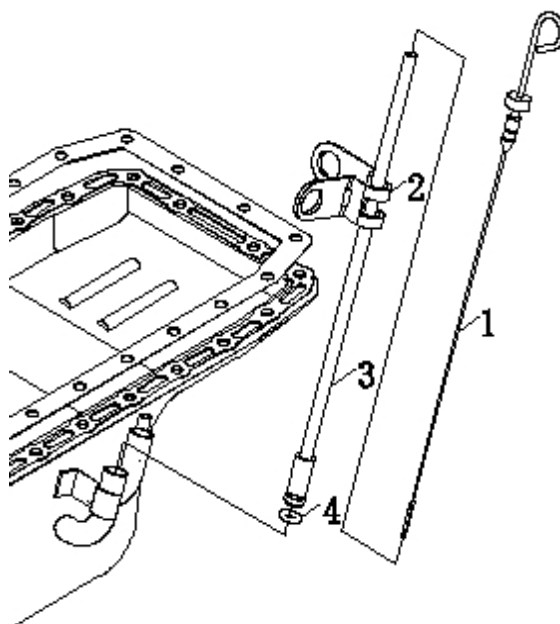
- (1) Before assembly, check if there is manufacturing defect or damage on the strainer, and make sure the strainer is intact.
- (2) Clean the inner chamber of strainer.
- (3) Assemble the subassembly of strainer.
- (4) Install the strainer subassembly to the engine block, and tighten up the hexagon flange face bolts.

[Check-up]

Check if there is crack or any other damage on the strainer, if there is, it is necessary to replace for a new one.

4.9.4 Disassembly and Assembly of Dipstick

4.9.4.1 Explosive View of Assembly of Dipstick



- 1.Oil dipstick 2.Dipstick guide pipe support 3.Dipstick guide 4.O-ring

Figure 4-46 Explosive View of Assembly of Dipstick



4.9.4.2 Disassembly and Assembly of Dipstick

[Disassembly Steps]

Pull out the dipstick.

[Assembly steps]

Plug in the dipstick.

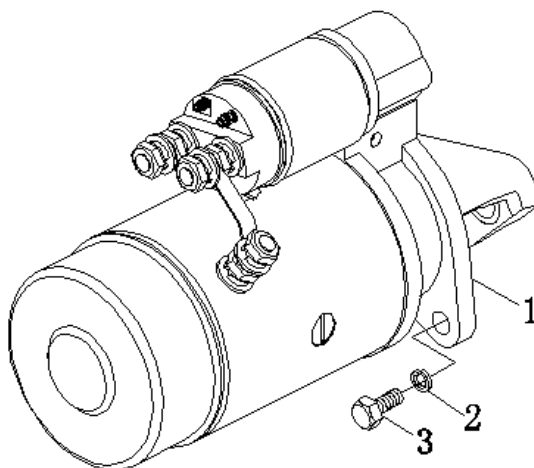
[Check-up]

- (1) Check if the dipstick cap is loosened or has come off, if so, replace for a new dipstick.
- (2) In order to ensure a correct oil level, the dipstick should be installed to lower subassembly of dipstick pipe leaving no clearance. After fixing the pipe of oil level indicator as required, check if the oil level indicator can be easily pushed in/pulled out.

4.10 Start-up System

4.10.4 Disassembly and Assembly of Start-up System

4.10.4.1 Explosive View of Assembly of Start-up System



1.Starter motor 2.Spring washer 3.Hexagon bolt

Fig. 4-47 Explosive View of Start-up System

4.10.1.2 Disassembly and Assembly of Start-up System

[Disassembly Steps]

- (1) Disassemble hexagon bolts and spring washer;
- (2) Catch tightly the starter with both hands, and remove it in the direction of spin axis of starter gear.

[Assembly Steps]

Assembly steps are opposite to disassembly steps.

[Check-up]

Check if starter gear teeth are damaged, if so, it is necessary to replace it.



Appendix A Tightening Torque of Universal Bolt

Table A.1 Recommended Torques of Standard Hexagon Bolt, Hexagon Nut and Inner Hexagon Cylinder-headed Bolt

Friction coefficient	0.125(phosphating, oxidizing)				0.14 (galvanizing)			
Strength grade	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9
Specification of bolts	Recommended torque N·m							
M4	2.3	2.7	3.8	4.6	2.4	2.9	4.1	4.9
M5	4.7	5.5	8.0	9.5	5.0	6.0	8.5	10
M6	8.0	9.5	13.0	16.0	8.5	10	14.0	17
M8	19	23	32	39	21	25	35	41
M10	39	46	64	77	41	49	69	83
M12	67	80	110	135	72	86	120	145
M14	105	125	180	215	115	135	190	230
M16	165	195	275	330	180	210	295	355
M18	225	270	390	455	245	290	405	485
M20	325	385	540	650	345	410	580	690
M22	435	510	720	870	465	550	780	930
M24	560	660	930	1100	600	710	1000	1200
M27	830	980	1400	1650	890	1050	1500	1800
M30	1100	1350	1850	2250	1200	1450	2000	2400
M8×1	21	25	35	42	23	27	38	45
M10×1.25	41	49	66	82	44	52	73	88
M12×1.25	74	88	125	150	80	95	135	155
M12×1.5	70	83	115	140	76	90	125	150
M14×1.5	115	140	195	235	125	150	210	250
M16×1.5	175	210	295	350	190	225	315	380
M18×1.5	255	305	425	510	275	325	460	550
M20×1.5	360	425	600	720	385	460	640	770
M22×1.5	480	570	800	960	520	610	860	1050
M24×1.5	610	720	1000	1200	650	780	1100	1300
M27×1.5	890	1050	1500	1800	970	1150	1600	1950
M30×1.5	1250	1450	2050	2500	1350	1600	2250	2700



Table A.2 Recommended Torques of Standard Hexagon Flange Face Bolt, and Hexagon Flange Face Nut

Friction coefficient	0.125(phosphating, oxidizing)				0.14 (galvanizing)			
Strength grade	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9
Specification of bolts	Recommended torque N·m							
M5	5.4	6.3	9.1	10.8	5.7	6.9	9.7	11.4
M6	9.0	10.7	14.6	18.0	9.6	11.2	15.7	19.1
M8	21.0	25.4	35.3	43.0	23.2	27.6	38.7	45.3
M10	42.9	50.6	70.4	84.7	45.2	54.0	76.0	91.4
M12	78.5	93.7	128.8	158.1	84.5	100.9	140.8	170.2
M14	117.0	139.3	200.5	239.5	128.3	150.6	212.0	256.6
M16	184.4	217.9	307.3	368.8	201.4	235.0	330.1	397.2
M18	254.3	305.1	440.7	514.2	277.3	328.3	458.4	549.0
M20	370.6	439.0	615.7	741.1	394.0	468.2	662.3	788.0

Table A.3 Recommended Torques of Hexagon Hollow Bolt

Type	Specification of bolts	Material	Setting of torque (N.m)
Hexagon hollow bolts	M10×1	Copper bolts	13±2
	M10×1	Steel bolts	21±3
	M14×1.5		27±3
	M16×1.5		40±5
	M6×1		6±1
Flange hollow bolts	M10		20±3
	M12		28±3
	M14		32±3
	M16		36±3



Appendix B Fit Clearance of Main Parts of Engine

No.	Item	Theoretical value (mm)
1	Main bearing clearances	0.059-0.117
2	Connecting rod bearing clearances	0.050-0.109
3	Crankshaft axial clearances	0.075~0.235
4	Connecting rod plane axial clearances	0.1-0.3
5	Clearance between connecting rod small end bush and piston pin	0.025-0.043
6	Clearance between piston pin seat bush and piston pin	0.005-0.019
7	Working clearance of cold-state piston ring opening	First ring
		Second ring
		Oil ring
8	Clearance of cold-state piston ring end surface	First ring
		Second ring
		Oil ring
9	Clearance between air intake valve rod and valve guide pipe	0.025-0.062
10	Clearance between air exhaust valve rod and valve guide pipe	0.04-0.077
11	Valve depression	0.4±0.1
12	Clearance between camshaft front end journal and bush inner diameter	0.089-0.139
13	Clearance between rocker arm and rockshaft	0.016-0.045
14	Tappet and engine block tappet hole	0.016-0.052
15	Gear backlash	Crankshaft gear/idle gear
		Camshaft gear/idle gear
		Fuel injection pump gear/idle gear





DSE Genset®



DEEP SEA ELECTRONICS PLC

DSE4510 MKII & DSE4520 MKII

Operator Manual

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DSE4510 MKII & DSE4520 MKII Operator Manual

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1 INTRODUCTION

This document details the installation and operation requirements of the DSE4510 MKII and DSE4520 MKII module and is part of the DSEGenset® range of products.

The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.

This is not a *controlled document*. DSE do not automatically inform on updates. Any future updates of this document are included on the DSE website at www.deepseapl.com

The DSE4xxx MKII series is designed to provide differing levels of functionality across a common platform. This allows the generator OEM greater flexibility in the choice of controller to use for a specific application.

The DSE45xx MKII modules have been designed to allow the operator to start and stop the generator, and if required, transfer the load to the generator either manually or automatically. Additionally, the DSE4520 MKII automatically starts and stops the generator set depending upon the status of the mains (utility) supply.

The user also has the facility to view the system operating parameters via the text LCD display.

The DSE45xx MKII modules monitor the engine, indicating the operational status and fault conditions, automatically shutting down the engine and giving a true first up fault condition of an engine failure by the text LCD display.

The powerful ARM microprocessor contained within the module allows for incorporation of a range of complex features:

- *Icon based LCD display*
- **True RMS** Voltage
- *Current and Power monitoring*
- *USB Communications*
- *Engine parameter monitoring.*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Engine ECU interface to **electronic engines***

The DSE Configuration Suite PC Software allows alteration of selected operational sequences, timers, alarms and operational sequences. Additionally, the module's integral front panel configuration editor allows adjustment of this information.

Access to critical operational sequences and timers for use by qualified engineers, can be protected by a security code. Module access can also be protected by PIN code. Selected parameters can be changed from the module's front panel.

The module is housed in a robust plastic case suitable for panel mounting. Connections to the module are via locking plug and sockets.



1.1 CLARIFICATION OF NOTATION

Clarification of notation used within this publication.

	NOTE:	Highlights an essential element of a procedure to ensure correctness.
	CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
	WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

1.2 GLOSSARY OF TERMS

Term	Description
DSE4000 MKII, DSE4xxx MKII	All modules in the DSE4xxx MKII range.
DSE4500 MKII, DSE45xx MKII	All modules in the DSE45xx MKII range.
DSE4510 MKII	DSE4510 MKII module/controller
DSE4520 MKII	DSE4520 MKII module/controller
CAN	Controller Area Network Vehicle standard to allow digital devices to communicate to one another.
CDMA	Code Division Multiple Access. Cell phone access used in small number of areas including parts of the USA and Australia.
CT	Current Transformer An electrical device that takes a large AC current and scales it down by a fixed ratio to a smaller current.
BMS	Building Management System A digital/computer based control system for a building's infrastructure.
DEF	Diesel Exhaust Fluid (AdBlue) A liquid used as a consumable in the SCR process to lower nitric oxide and nitrogen dioxide concentration in engine exhaust emissions.
DM1	Diagnostic Message 1 A DTC that is currently active on the engine ECU.
DM2	Diagnostic Message 2 A DTC that was previously active on the engine ECU and has been stored in the ECU's internal memory.
DPF	Diesel Particulate Filter A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas.
DPTC	Diesel Particulate Temperature Controlled Filter A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas which is temperature controlled.
DTC	Diagnostic Trouble Code The name for the entire fault code sent by an engine ECU.
ECU/ECM	Engine Control Unit/Management An electronic device that monitors engine parameters and regulates the fuelling.
FMI	Failure Mode Indicator A part of DTC that indicates the type of failure, e.g. high, low, open circuit etc.

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Term	Description
GSM	Global System for Mobile communications. Cell phone technology used in most of the World.
HEST	High Exhaust System Temperature Initiates when DPF filter is full in conjunction with an extra fuel injector in the exhaust system to burn off accumulated diesel particulate matter or soot.
HMI	Human Machine Interface A device that provides a control and visualisation interface between a human and a process or machine.
OC	Occurrence Count A part of DTC that indicates the number of times that failure has occurred.
PGN	Parameter Group Number A CAN address for a set of parameters that relate to the same topic and share the same transmission rate.
PLC	Programmable Logic Controller A programmable digital device used to create logic for a specific purpose.
SCADA	Supervisory Control And Data Acquisition A system that operates with coded signals over communication channels to provide control and monitoring of remote equipment
SCR	Selective Catalytic Reduction A process that uses DEF with the aid of a catalyst to convert nitric oxide and nitrogen dioxide into nitrogen and water to reduce engine exhaust emission.
SIM	Subscriber Identity Module. The small card supplied by the GSM/CDMA provider that is inserted into the cell phone, GSM modem or DSEGateway device to give GSM/GPRS connection.
SMS	Short Message Service The text messaging service of mobile/cell phones.
SPN	Suspect Parameter Number A part of DTC that indicates what the failure is, e.g. oil pressure, coolant temperature, turbo pressure etc.



1.3 BIBLIOGRAPHY

This document refers to, and is referred by the following DSE publications which are obtained from the DSE website: www.deepseapl.com or by contacting DSE technical support: support@deepseapl.com.

1.3.1 INSTALLATION INSTRUCTIONS

Installation instructions are supplied with the product in the box and are intended as a 'quick start' guide only.

DSE Part	Description
053-190	DSE4510 MKII & DSE4520 MKII Installation Instructions

1.3.2 MANUALS

Product manuals are obtained from the DSE website: www.deepseapl.com or by contacting DSE technical support: support@deepseapl.com.

DSE Part	Description
N/A	Gencomm (MODBUS protocol for DSE controllers)
057-004	Electronic Engines and DSE Wiring Guide
057-151	DSE Configuration Suite PC Software Installation & Operation Manual
057-220	Options for Communications with DSE Controllers
057-258	DSE4510 MKII & DSE4520 MKII DSE Configuration Suite PC Software Manual



1.3.3 TRAINING GUIDES

Training guides are provided as 'hand-out' sheets on specific subjects during training sessions and contain specific information regarding to that subject.

DSE Part	Description
056-005	Using CTs With DSE Products
056-006	Introduction to Comms
056-010	Over Current Protection
056-022	Breaker Control
056-023	Adding New CAN Files
056-026	kW, kvar, kVA and pf.
056-029	Smoke Limiting
056-030	Module PIN Codes
056-055	Alternate Configurations
056-069	Firmware Update
056-075	Adding Language Files
056-076	Reading DSEGencom Alarms
056-079	Reading DSEGencom Status
056-080	MODBUS
056-081	Screen Heaters
056-082	Override Gencomm PLC Example

1.3.4 THIRD PARTY DOCUMENTS

The following third party documents are also referred to:

Reference	Description
ISBN 1-55937-879-4	IEEE Std C37.2-1996 IEEE Standard Electrical Power System Device Function Numbers and Contact Designations. Institute of Electrical and Electronics Engineers Inc
ISBN 0-7506-1147-2	Diesel generator handbook. L.L.J. Mahon
ISBN 0-9625949-3-8	On-Site Power Generation. EGSA Education Committee.



2 SPECIFICATION

2.1 OPERATING TEMPERATURE

Module	Specification
DSE45xx MKII	-30 °C +70 °C (-22 °F +158 °F)
Display Heater Variants	-40 °C +70 °C (-40 °F +158 °F)

2.1.1 OPTIONAL SCREEN HEATER OPERATION

Screen Heater Function	Specification
Turn On When Temperature Falls Below	-10 °C (+14 °F)
Turn Off When Temperature Rises Above	-5 °C (+23 °F)

2.2 REQUIREMENTS FOR UL

Description	Specification
Screw Terminal Tightening Torque	4.5 lb-in (0.5 Nm)
Conductors	Terminals suitable for connection of conductor size 12 AWG to 26 AWG (0.5 mm² to 2.0 mm²). Conductor protection must be provided in accordance with NFPA 70, Article 240 Low voltage circuits (35 V or less) must be supplied from the engine starting battery or an isolated secondary circuit. The communication, sensor, and/or battery derived circuit conductors shall be separated and secured to maintain at least ¼" (6 mm) separation from the generator and mains connected circuit conductors unless all conductors are rated 600 V or greater.
Current Inputs	Must be connected through UL Listed or Recognized isolating current transformers with the secondary rating of 5 A max.
Communication Circuits	Must be connected to communication circuits of UL Listed equipment
Output Pilot Duty	0.5 A
Mounting	Suitable for use in type 1 Enclosure Type rating with surrounding air temperature -22 °F to +158 °F (-30 °C to +70 °C) Suitable for pollution degree 3 environments when voltage sensing inputs do not exceed 300 V. When used to monitor voltages over 300 V device to be installed in an unventilated or filtered ventilation enclosure to maintain a pollution degree 2 environment.
Operating Temperature	-22 °F to +158 °F (-30 °C to +70 °C)
Storage Temperature	-40 °F to +176 °F (-40 °C to +80 °C)



2.3 TERMINAL SPECIFICATION

Description	Specification	
Connection Type	Two part connector. Male part fitted to module Female part supplied in module packing case - Screw terminal, rising clamp, no internal spring.	 Example showing cable entry and screw terminals of a 10 way connector
Minimum Cable Size	0.5 mm ² (AWG 24)	
Maximum Cable Size	2.5 mm ² (AWG 12)	
Tightening Torque	0.5 Nm (4.5 lb-in)	
Wire Strip Length	7 mm (9/32")	

2.4 POWER SUPPLY REQUIREMENTS

Description	Specification
Minimum Supply Voltage	8 V continuous, 5 V for up to 1 minute.
Cranking Dropouts	Able to survive 0 V for 100 ms providing the supply was at least was greater than 5 V for 2 seconds before the dropout and recovers to 5 V afterwards.
Maximum Supply Voltage	35 V continuous (60 V protection)
Reverse Polarity Protection	-35 V continuous
Maximum Operating Current	96 mA at 12 V 85 mA at 24 V
Maximum Standby Current	51 mA at 12 V 47 mA at 24 V
Maximum Current When In Sleep Mode	35 mA at 12 V 32 mA at 24 V
Maximum Current When In Deep Sleep Mode	Less than 10 µA at 12 V Less than 10 µA at 24 V
Typical Power (Controller On, Heater Off)	3.8 W to 4.1 W
Typical Power (Controller On, Heater On)	6.8 W to 7.1 W

2.4.1 MODULE SUPPLY INSTRUMENTATION DISPLAY

Description	Specification
Range	0 V to 70 V DC (Maximum continuous operating voltage of 35 V DC)
Resolution	0.1 V
Accuracy	1 % full scale (±0.35 V)



2.5 VOLTAGE & FREQUENCY SENSING

Description	Specification
Measurement Type	True RMS conversion
Harmonics	Up to 11 th
Input Impedance	450 k Ω phase to neutral
Phase To Neutral	15 V (minimum required for sensing frequency) to 415 V AC (absolute maximum) Suitable for 345 V AC nominal (± 20 % for under/overvoltage detection)
Phase To Phase	25 V (minimum required for sensing frequency) to 720 V AC (absolute maximum) Suitable for 600 V AC nominal (± 20 % for under/overvoltage detection)
Common Mode Offset From Earth	100 V AC (max)
Resolution	1 V AC phase to neutral 2 V AC phase to phase
Accuracy	± 1 % of full scale phase to neutral ± 2 % of full scale phase to phase
Minimum Frequency	3.5 Hz
Maximum Frequency	75.0 Hz
Frequency Resolution	0.1 Hz
Frequency Accuracy	± 0.05 Hz

2.6 CURRENT SENSING

Description	Specification
Measurement Type	True RMS conversion
Harmonics	Up to 11 th
Nominal CT Secondary Rating	1 A and 5 A
Maximum Continuous Current	5 A
Absolute Maximum Overload	15 A for 1 second
Burden	0.25 VA (0.01 Ω current shunts)
Resolution	25 mA
Accuracy	± 1 % of Nominal (excluding CT error)



2.6.1 VA RATING OF THE CTS

NOTE: Details for 4 mm² cables are shown for reference only. The connectors on the DSE modules are only suitable for cables up to 2.5 mm².

The VA burden of the module on the CTs is 0.25 VA. However depending upon the type and length of cabling between the CTs and the module, CTs with a greater VA rating than the module are required.

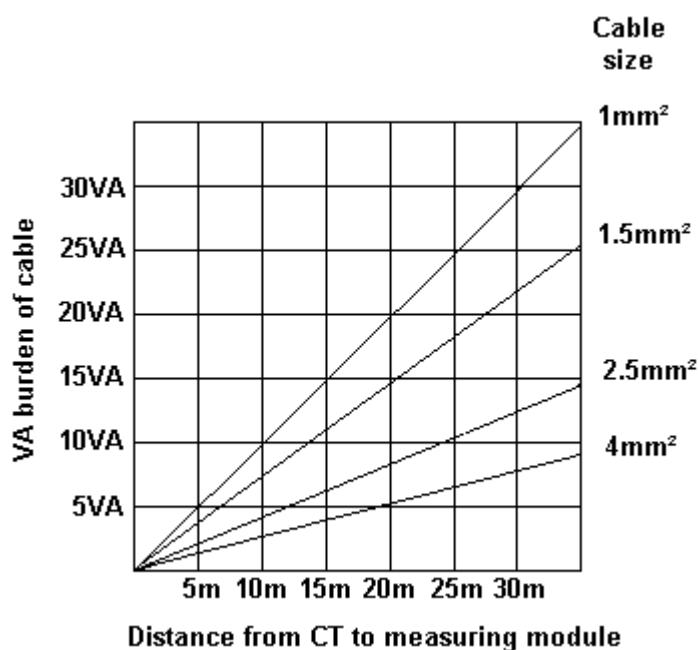
The distance between the CTs and the measuring module should be estimated and cross-referenced against the chart opposite to find the VA burden of the cable itself.

If the CTs are fitted within the alternator top box, the star point (common) of the CTs should be connected to system ground (earth) as close as possible to the CTs. This minimises the length of cable used to connect the CTs to the DSE module.

Example:

If 1.5 mm² cable is used and the distance from the CT to the measuring module is 20 m, then the burden of the cable alone is approximately 15 VA. As the burden of the DSE controller is 0.25 VA, then a CT with a rating of at least 15 VA + 0.25 VA = 15.25 VA

must be used. If 2.5 mm² cables are used over the same distance of 20 m, then the burden of the cable on the CT is approximately 7 VA. CT's required in this instance is at least 7.25 VA (7 + 0.25).

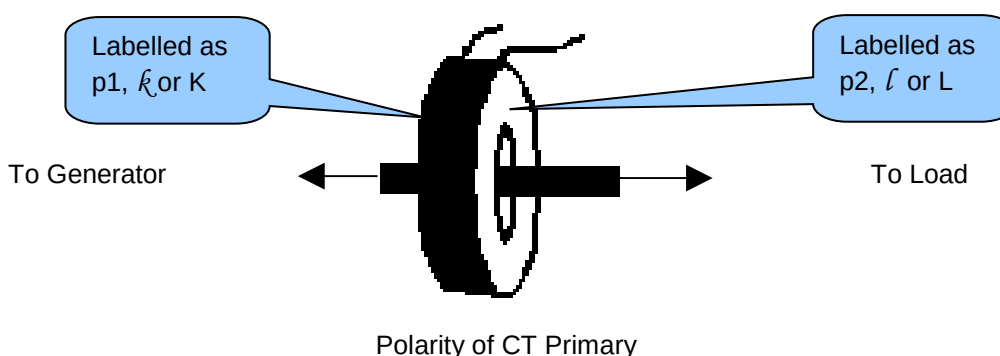


2.6.2 CT POLARITY

NOTE: Take care to ensure correct polarity of the CT primary as shown above. If in doubt, check with the CT supplier.

Take care to ensure the correct polarity of the CTs. Incorrect CT orientation leads to negative kW readings when the set is supplying power. Take note that paper stick-on labels on CTs that show the orientation are often incorrectly placed on the CT. It is more reliable to use the labelling in the case moulding as an indicator to orientation (if available).

To test orientation, run the generator in island mode (not in parallel with any other supply) and load the generator to around 10 % of the set rating. Ensure the DSE module shows positive kW for all three individual phase readings.



2.6.3 CT PHASING

Take particular care that the CTs are connected to the correct phases. For instance, ensure that the CT on phase 1 is connected to the terminal on the DSE module intended for connection to the CT for phase 1.

Additionally ensure that the voltage sensing for phase 1 is actually connected to generator phase 1. Incorrect connection of the phases as described above results in incorrect power factor (pf) measurements, which in turn results in incorrect kW measurements.

One way to check for this is to make use of a single-phase load. Place the load on each phase in turn, run the generator and ensure the kW value appears in the correct phase. For instance if the load is connected to phase 3, ensure the kW figure appears in phase 3 display and not in the display for phase 1 or 2.

2.6.4 CT CLASS

Ensure the correct CT type is chosen. For instance if the DSE module is providing over current protection, ensure the CT is capable of measuring the overload level required to protect against, and at the accuracy level required.

For instance, this may mean fitting a protection class CT (P15 type) to maintain high accuracy while the CT is measuring overload currents.

Conversely, if the DSE module is using the CT for instrumentation only (current protection is disabled or not fitted to the controller), then measurement class CTs can be used. Again, bear in mind the accuracy required. The DSE module is accurate to better than 1% of the full-scale current reading. To maintain this accuracy, fit a Class 0.5 or Class 1 CT.

Check with the CT manufacturer for further advice on selecting CTs.



2.7 INPUTS

2.7.1 DIGITAL INPUTS

Description	Specification
Number	4 configurable digital inputs (7 when <i>Analogue Inputs</i> are configured as digital inputs)
Arrangement	Contact between terminal and ground
Low Level Threshold	3.2 V minimum
High Level Threshold	8.1 V maximum
Maximum Input Voltage	+60 V DC with respect to module DC supply negative
Minimum Input Voltage	-24 V DC with respect to module DC supply negative
Contact Wetting Current	6 mA typical
Open Circuit Voltage	12 V typical

2.7.2 ANALOGUE INPUTS

2.7.2.1 ANALOGUE INPUT A

Description	Specification
Input Type	Oil Pressure Sensor
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement Current	11 mA $\pm 10\%$
Full Scale	240 Ω
Over Range / Fail	270 Ω
Resolution	0.1 bar (1-2 PSI)
Accuracy	$\pm 2\%$ of full scale resistance ($\pm 4.8\ \Omega$) excluding transducer error
Max Common Mode Voltage	$\pm 2\text{ V}$
Display Range	0 bar to 17.2 bar (0 PSI to 250 PSI) subject to limits of the sensor and sensor configuration

2.7.2.2 ANALOGUE INPUT B

Description	Specification
Input Type	Coolant Temperature Sensor
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement Current	11 mA $\pm 10\%$
Full Scale	480 Ω
Over Range / Fail	540 Ω
Resolution	1°C (2°F)
Accuracy	$\pm 2\%$ of full scale resistance ($\pm 9.6\ \Omega$) excluding transducer error
Max Common Mode Voltage	$\pm 2\text{ V}$
Display Range	0 °C to 250 °C (32 °F to 482 °F) subject to limits of the sensor and sensor configuration



2.7.2.3 ANALOGUE INPUT C

Description	Specification
Input Type	Fuel Level Sensor or Flexible Sensor
Flexible Input Selection	Pressure Sensor, Percentage Sensor or Temperature Sensor
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement Current	15 mA $\pm$ 10 %
Full Scale	480 Ω
Over Range / Fail	600 Ω
Resolution	$\pm$ 1 % of full scale
Accuracy	$\pm$ 2 % of full scale resistance ($\pm$ 9.6 Ω) excluding sensor error
Max Common Mode Voltage	$\pm$ 2 V
Display Range	0 % to 250 %, 0 °C to 250 °C (32 °F to 482 °F) or 0 bar to 17.2 bar (0 PSI to 250 PSI) subject to limits of the sensor and sensor configuration

2.7.3 CHARGE FAIL INPUT

The charge fail input is actually a combined input and output. Whenever the generator is required to run, the terminal provides excitation current to the charge alternator field winding.

When the charge alternator is correctly charging the battery, the voltage of the terminal is close to the plant battery supply voltage. In a failed charge situation, the voltage of this terminal is pulled down to a low voltage. It is this drop in voltage that triggers the *Charge Failure* alarm. The level at which this operates and whether this triggers a warning or shutdown alarm is configurable using the DSE Configuration Suite Software.

Description	Specification
Minimum Voltage	0 V
Maximum Voltage	35 V
Resolution	0.2 V
Accuracy	$\pm$ 1 % of full scale
Excitation	Active circuit constant power output
Output Power	2.5 W nominal at 12 V and 24 V
Current At 12V	210 mA
Current At 24V	105 mA



2.8 OUTPUTS

2.8.1 DC OUTPUTS A & B (FUEL & START)

Description	Specification
Type	Normally used as Fuel & Start outputs. Fully configurable for other purposes if the module is configured to control an electronic engine, supplied from DC supply terminal 2.
Rating	10 A resistive for 10 seconds, 5 A resistance continuous at module supply.

2.8.2 DC OUTPUTS C, D, E & F

Description	Specification
Type	Fully configurable, supplied from DC supply terminal 2.
Rating	2 A resistive at module supply.

2.9 COMMUNICATION PORTS



NOTE: All communication ports can be used at the same time.

Description	Specification
USB Slave Port	Type B USB 2.0 For connection to PC running DSE Configuration Suite Max distance 6 m (20 feet)
CAN Port	NOTE: For additional length, the DSE124 CAN & MSC Extender is available. For more information, refer to DSE Publication: 057-116 DSE124 Operator Manual Engine CAN Port Standard implementation of 'Slow mode', up to 250 kb/s Non-Isolated. Internal Termination provided (120 Ω) Max distance 40 m (133 feet)



2.10 COMMUNICATION PORT USAGE

2.10.1 USB SLAVE PORT (PC CONFIGURATION)

NOTE: DSE stock 2 m (6.5 feet) USB type A to type B cable, DSE Part Number: 016-125. Alternatively they are purchased from any PC or IT store.

NOTE: The DC supply must be connected to the module for configuration by PC.

NOTE: For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual.**

The USB port is provided to give a simple means of connection between a PC and the controller. Using the DSE Configuration Suite Software, the operator is then able to control the module, starting or stopping the engine, selecting operating modes, etc.

Additionally, the various operating parameters (such as coolant temperature, oil pressure, etc.) of the engine are available to be viewed or changed.

To connect a module to a PC by USB, the following items are required:

DSE45xx MKII Controller



DSE Configuration Suite PC Software
(Supplied on configuration suite software CD or available from www.deepseapl.com).



USB cable Type A to Type B.
(This is the same cable as often used between a PC and a USB printer)

DSE can supply this cable if required :
PC Configuration interface lead (USB type A – type B) DSE Part No 016-125



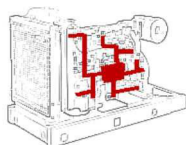
2.10.2 CAN PORT (J1939)

NOTE: For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN link.
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for CAN use (DSE part number 016-030)

NOTE: For additional length, the DSE124 CAN & MSC Extender is available. For more information, refer to DSE Publication: *057-116 DSE124 Operator Manual*



The modules are fitted with a CAN interface as standard and are capable of receiving engine data from engine ECU/ECMs compliant with the CAN J1939 standard.

ECU/ECMs monitor the engine's operating parameters such as speed, oil pressure, coolant temperature (among others) in order to closely monitor and control the engine. The industry standard communications interface (CAN) transports data gathered by the engine's ECU/ECM using the J1939 protocol. This allows engine controllers such as DSE to access these engine parameters with no physical connection to the sensor device.

The *ECU Port* is used for point-to-point cable connection of more than one device and allows for connection to CAN Scanner, PLC and CAN controllers (to name just a few devices). The operator is then able to view the various operating parameters.



2.10.2.1 J1939-75

NOTE: For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Software Manual.**

When the J1939-75 is enabled in the module's configuration, the module's AC measurements and alarms are sent onto the CANbus using the *ECU Port* to be received by an external monitoring device. There are two check boxes to enable each of the two parts of the interface as shown below, AC measurement and AC related alarms. The module AC alarms are translated into J1939 DM1 diagnostic messages. There are no additional display screens visible on the module when these options are selected.

Miscellaneous Options

J1939-75 Instrumentation Enable ☒

J1939-75 Alarms Enable ☒

The default CAN source address for additional J1939-75 messages is 44 however this may be changed by the generator supplier.

Miscellaneous

CAN source address (engine messages) 0

CAN source address (instrumentation) 44



Transmitted PGNs

PGN Message	PGN	Update Rate
DM1	65226	1000 ms
GAAC	65030	1000 ms
GPAAC	65027	1000 ms
GPBAC	65024	1000 ms
GPCAC	65021	1000 ms
GTACP	65029	1000 ms
GTACR	65028	1000 ms
ACS	64913	2500 ms

DM1 Alarms

Alarms	FMI	SPN
Over Phase Voltage Warning	15	2444
Under Phase Voltage Warning	17	2444
Over Phase Voltage Shutdown	0	2444
Under Phase Voltage Shutdown	1	2444
Over Phase Voltage Warning	15	2440
Under Phase Voltage Warning	17	2440
Over Phase Voltage Shutdown	0	2440
Under Phase Voltage Shutdown	1	2440
Over Phase Voltage Warning	15	2436
Under Phase Voltage Warning	17	2436
Over Phase Voltage Shutdown	0	2436
Under Phase Voltage Shutdown	1	2436
Over Line Current Warning	15	2448
Over Line Current Shutdown	0	2448
Oil Pressure Sender Fault	2	100
Oil Pressure Low Shutdown	1	100
Coolant Sender Fault	2	110
Coolant Temperature High Shutdown	0	110
Fuel Level High Warning	15	96
Fuel Level Low Warning	17	96
Fuel Level High Shutdown	0	96
Fuel Level Low Shutdown	1	96
Over Speed Shutdown	0	190
Under Speed Shutdown	1	190
Plant Battery Over Voltage Warning	15	168
Plant Battery Under Voltage Warning	17	168
Charge Alt Voltage	17	167
Charge Alt Shutdown	1	167



Generator Instrumentation

Instrument	SPN	PGN	PGN Message	Units	Scaling
Generator Average AC RMS Current	2448	65030	GAAC	A	1
Generator Average AC Frequency	2436	65030	GAAC	Hz	128
Generator Average Line Neutral AC RMS Voltage	2444	65030	GAAC	V	1
Generator Average Line to Line AC RMS Voltage	2440	65030	GAAC	V	1
Generator Phase A AC RMS Current	2449	65027	GPAAC	A	1
Generator Phase A AC Frequency	2437	65027	GPAAC	Hz	128
Generator Phase A Line Neutral AC RMS Voltage	2445	65027	GPAAC	V	1
Generator Phase A Line to Line AC RMS Voltage	2441	65027	GPAAC	V	1
Generator Phase A Real Power	2453	65026	GPAACP	W	1
Generator Phase A Apparent Power	2461	65026	GPAACP	VA	1
Generator Phase A Reactive Power	2457	65025	GPAACR	var	1
Generator Phase B AC RMS Current	2450	65024	GPBAC	A	1
Generator Phase B AC Frequency	2438	65024	GPBAC	Hz	128
Generator Phase B Line Neutral AC RMS Voltage	2446	65024	GPBAC	V	1
Generator Phase B Line to Line AC RMS Voltage	2442	65024	GPBAC	V	1
Generator Phase B Real Power	2454	65023	GPBACP	W	1
Generator Phase B Apparent Power	2462	65023	GPBACP	VA	1
Generator Phase B Reactive Power	2458	65022	GPBACR	var	1
Generator Phase C AC RMS Current	2451	65021	GPCAC	A	1
Generator Phase C AC Frequency	2439	65021	GPCAC	Hz	128
Generator Phase C Line Neutral AC RMS Voltage	2447	65021	GPCAC	V	1
Generator Phase C Line to Line AC RMS Voltage	2443	65021	GPCAC	V	1
Generator Phase C Real Power	2455	65020	GPCACP	W	1
Generator Phase C Apparent Power	2463	65020	GPCACP	VA	1
Generator Phase C Reactive Power	2459	65019	GPCACR	var	1
Generator Total Apparent Power	2460	65029	GTACP	W	1
Generator Total Real Power	2452	65029	GTACP	VA	1
Generator Overall Power Factor	2464	65028	GTACR	Lead/Lag	
Generator Total Reactive Power	2456	65028	GTACR	var	1
Generator Breaker Status	3545	64913	ACS		1
Generator Total Real Power (W)	3590	64911	GTACPP	%	1



Engine Instrumentation

Instrument	SPN	PGN	PGN Message	Units	Scaling
Engine Speed	190	61444	EEC1	rpm	0.125 rpm/bit, 0 rpm to 8031.875 rpm
Oil Pressure	100	65263	EFL_P1	kPa	4 kPa/bit 0 kPa to 1000 kPa
Coolant Temperature	110	65262	ET1	°C	1 °C/bit, -40 °C Offset -40 °C to 210 °C
Fuel Level	96	65276	DD	V	0.4 %/bit, 0 %to 100 %
Plant Battery Voltage	168	65271	VEP1	V	0.05 V/bit, 0 V to 3212.75V
Charge Alternator Voltage	167	65271	VEP1	V	0.05V/bit, 0 V to 3212.75V
Crank Attempt Count On Present Start Attempt	3674	65214	EEC4		1 count/bit 0 offset
Maximum Crank Attempts Per Start Attempt	3670	64895	EC2		1 count/bit 0 offset
Engine Run Hours	247	65253	HOURS	Hours	0.05 hours/bit, 0 offset
Emergency Stop	3607	64914	EOI		1 = Estop 0 = No Estop



2.11 ADDING AN EXTERNAL SOUNDER

Should an external alarm or indicator be required, this can be achieved by using the DSE Configuration Suite PC software to configure an auxiliary output for *Audible Alarm*, and by configuring an auxiliary input for *Alarm Mute*.

The audible alarm output activates and de-activates at the same time as the module's internal sounder. The *Alarm Mute* input de-activates audible alarm output.

Example of configuration to achieve external sounder with external alarm mute button:

The screenshot displays two configuration windows from the DSE Configuration Suite software. The top window, titled "Relay Outputs (DC Supply Out)", shows "Output E" configured with "Source" set to "Audible Alarm" and "Polarity" set to "Energise". The bottom window, titled "Digital Input A", shows "Function" set to "Alarm Mute", "Polarity" set to "Close to Activate", and "Action" set to "De-activate". The "Arming" dropdown is also visible. The "LCD Display" section shows a horizontal bar, and the "Activation Delay" is set to 0s.

2.12 ACCUMULATED INSTRUMENTATION



NOTE: When an accumulated instrumentation value exceeds the maximum number as listed below, the value is reset and begins counting from zero again.

The number of logged *Engine Hours* and *Number of Starts* can be set/reset using the DSE Configuration Suite PC software. Depending upon module configuration, this may have been PIN number locked by the generator supplier.

Description	Specification
Engine Hours Run	Maximum 99999 hrs 59 minutes (Approximately 11yrs 4 months)
Number of Starts	1,000,000 (1 Million)
Accumulated Power	999999 kWh / kvarh / kVAh



2.13 DIMENSIONS AND MOUNTING

2.13.1 DIMENSIONS

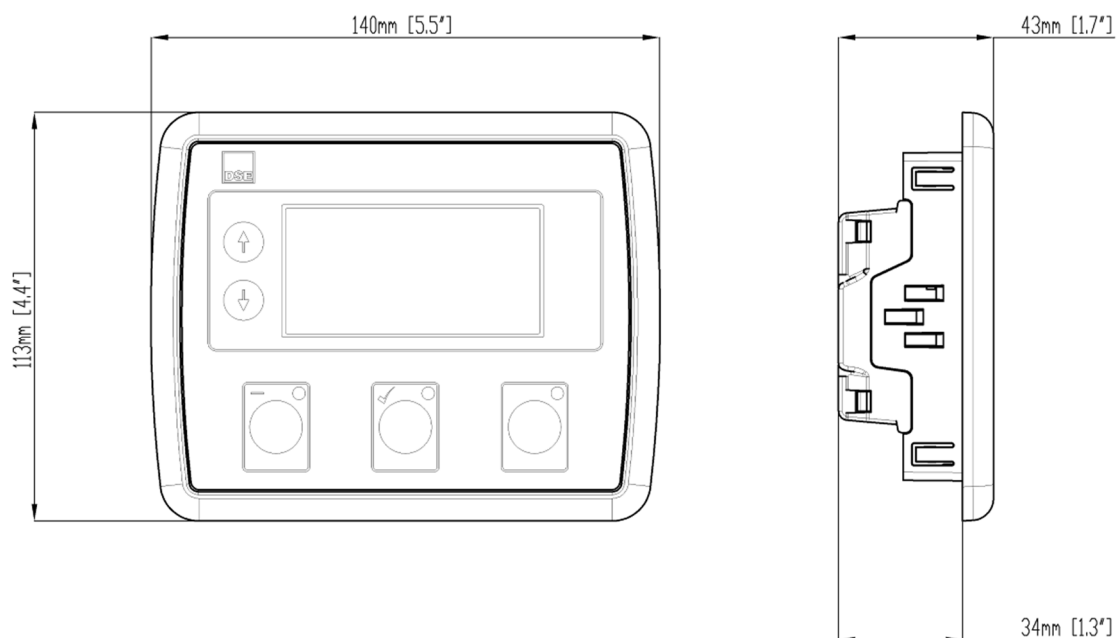
140 mm x 113 mm x 43 mm
(5.5 " x 4.4 " x 1.7 ")

2.13.2 PANEL CUTOUT

118 mm x 92 mm
(4.6 " x 3.6 ")

2.13.3 WEIGHT

0.16 kg
(0.35 lb)



2.13.4 FIXING CLIPS

NOTE: In conditions of excessive vibration, mount the module on suitable anti-vibration mountings.

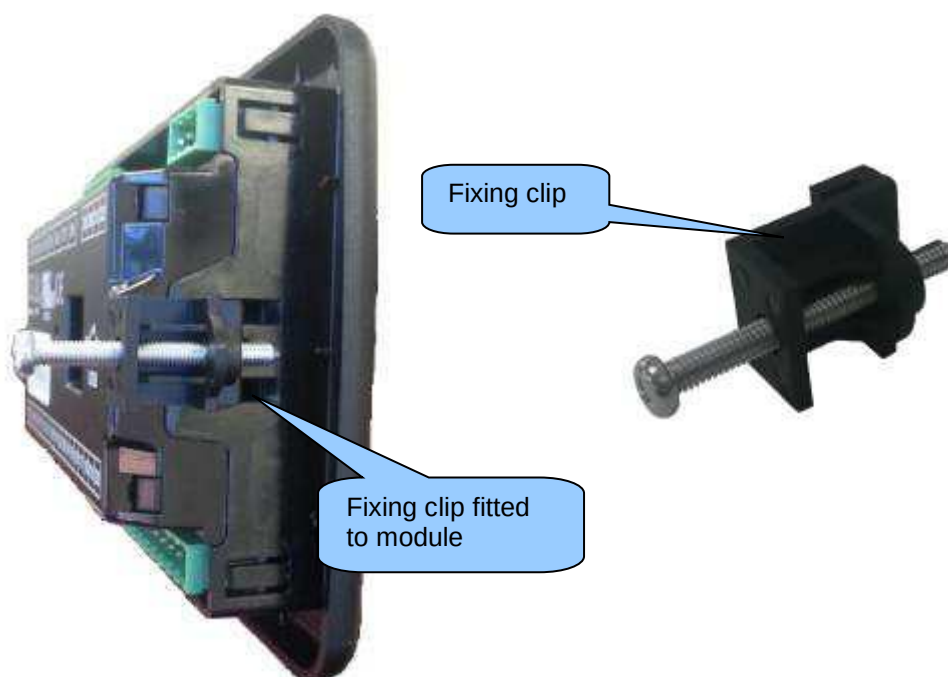
The module is held into the panel fascia using the supplied fixing clips.

Withdraw the fixing clip screw (turn anticlockwise) until only the pointed end is protruding from the clip. Insert the three 'prongs' of the fixing clip into the slots in the side of the module case.

Pull the fixing clip backwards (towards the back of the module) ensuring all three prongs of the clip are inside their allotted slots.

Turn the fixing clip screws clockwise until they make contact with the panel fascia.

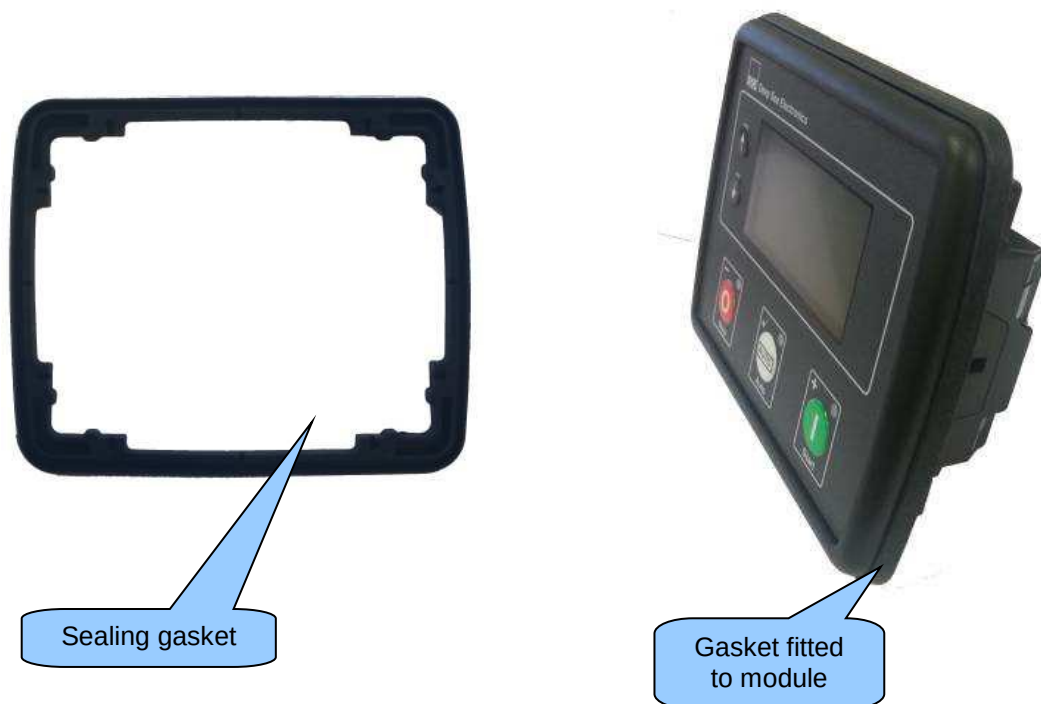
Turn the screw a quarter of a turn to secure the module into the panel fascia. Care must be taken not to over tighten the fixing clip screws.



2.13.5 OPTIONAL SILICON SEALING GASKET

NOTE: For purchasing a silicon gasket from DSE, see the section entitled Maintenance, Spares, Repair and Servicing elsewhere in this document.

The silicon gasket provides improved sealing between module and the panel fascia. The gasket is fitted to the module before installation into the panel fascia. Take care to ensure the gasket is correctly fitted to the module to maintain the integrity of the seal.



2.14 APPLICABLE STANDARDS

Standard	Description
BS 4884-1	This document conforms to BS4884-1 1992 Specification for presentation of essential information.
BS 4884-2	This document conforms to BS4884-2 1993 Guide to content
BS 4884-3	This document conforms to BS4884-3 1993 Guide to presentation
BS EN 60068-2-1 (Minimum temperature)	-30 °C (-22 °F)
BS EN 60068-2-2 (Maximum temperature)	+70 °C (158 °F)
BS EN 60950	Safety of information technology equipment, including electrical business equipment
BS EN 61000-6-2	EMC Generic Immunity Standard (Industrial)
BS EN 61000-6-4	EMC Generic Emission Standard (Industrial)
BS EN 60529 (Degrees of protection provided by enclosures)	IP65 (front of module when installed into the control panel with the optional sealing gasket) IP42 (front of module when installed into the control panel WITHOUT being sealed to the panel)
UL508 NEMA rating (Approximate)	12 (Front of module when installed into the control panel with the optional sealing gasket). 2 (Front of module when installed into the control panel WITHOUT being sealed to the panel)
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Under the scope of IEEE 37.2, function numbers can also be used to represent functions in microprocessor devices and software programs. The controller is device number 11L-8000 (Multifunction device protecting Line (generator) –module). As the module is configurable by the generator OEM, the functions covered by the module vary. Depending on module configuration, the device numbers included within the module could be: 2 – Time Delay Starting Or Closing Relay 3 – Checking Or Interlocking Relay 5 – Stopping Device 6 – Starting Circuit Breaker 8 – Control Power Disconnecting Device 10 – Unit Sequence Switch 11 – Multifunction Device 12 – Overspeed Device 14 – Underspeed Device 26 – Apparatus Thermal Device 27AC – AC Undervoltage Relay 27DC – DC Undervoltage Relay 29 – Isolating Contactor Or Switch 30 – Annunciator Relay 31 – Separate Excitation Device 42 – Running Circuit Breaker

Continued over the page...



Standard	Description
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Continued... 50 – Instantaneous Overcurrent Relay 52 – AC Circuit Breaker 53 – Exciter Or DC Generator Relay 54 – Turning Gear Engaging Device 59AC – AC Overvoltage Relay 59DC – DC Overvoltage Relay 62 – Time Delay Stopping Or Opening Relay 63 – Pressure Switch 71 – Level Switch 74 – Alarm Relay 81 – Frequency Relay 83 – Automatic Selective Control Or Transfer Relay 86 – Lockout Relay

In line with our policy of continual development, Deep Sea Electronics, reserve the right to change specification without notice.



2.14.1 ENCLOSURE CLASSIFICATIONS

2.14.1.1 IP CLASSIFICATIONS

The modules specification under BS EN 60529 Degrees of protection provided by enclosures

IP65 (Front of module when module is installed into the control panel with the optional sealing gasket).

IP42 (front of module when module is installed into the control panel WITHOUT being sealed to the panel)

First Digit	Second Digit
Protection against contact and ingress of solid objects	Protection against ingress of water
0 No protection	0 No protection
1 Protected against ingress solid objects with a diameter of more than 50 mm. No protection against deliberate access, e.g. with a hand, but large surfaces of the body are prevented from approach.	1 Protection against dripping water falling vertically. No harmful effect must be produced (vertically falling drops).
2 Protected against penetration by solid objects with a diameter of more than 12 mm. Fingers or similar objects prevented from approach.	2 Protection against dripping water falling vertically. There must be no harmful effect when the equipment (enclosure) is tilted at an angle up to 15° from its normal position (drops falling at an angle).
3 Protected against ingress of solid objects with a diameter of more than 2.5 mm. Tools, wires etc. with a thickness of more than 2.5 mm are prevented from approach.	3 Protection against water falling at any angle up to 60° from the vertical. There must be no harmful effect (spray water).
4 Protected against ingress of solid objects with a diameter of more than 1 mm. Tools, wires etc. with a thickness of more than 1 mm are prevented from approach.	4 Protection against water splashed against the equipment (enclosure) from any direction. There must be no harmful effect (splashing water).
5 Protected against harmful dust deposits. Ingress of dust is not totally prevented but the dust must not enter in sufficient quantity to interface with satisfactory operation of the equipment. Complete protection against contact.	5 Protection against water projected from a nozzle against the equipment (enclosure) from any direction. There must be no harmful effect (water jet).
6 Protection against ingress of dust (dust tight). Complete protection against contact.	6 Protection against heavy seas or powerful water jets. Water must not enter the equipment (enclosure) in harmful quantities (splashing over).

2.14.1.2 NEMA CLASSIFICATIONS



NOTE: There is no direct equivalence between IP / NEMA ratings. IP figures shown are approximate only.

12 (Front of module when module is installed into the control panel with the optional sealing gasket).

2 (Front of module when module is installed into the control panel WITHOUT being sealed to the panel)

1	Provides a degree of protection against contact with the enclosure equipment and against a limited amount of falling dirt.
IP30	
2	Provides a degree of protection against limited amounts of falling water and dirt.
IP31	
3	Provides a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
IP64	
3R	Provides a degree of protection against rain and sleet; undamaged by the formation of ice on the enclosure.
IP32	
4 (X)	Provides a degree of protection against splashing water, windblown dust and rain, hose directed water; undamaged by the formation of ice on the enclosure. (Resist corrosion).
IP66	
12/12K	Provides a degree of protection against dust, falling dirt and dripping non corrosive liquids.
IP65	
13	Provides a degree of protection against dust and spraying of water, oil and non corrosive coolants.
IP65	



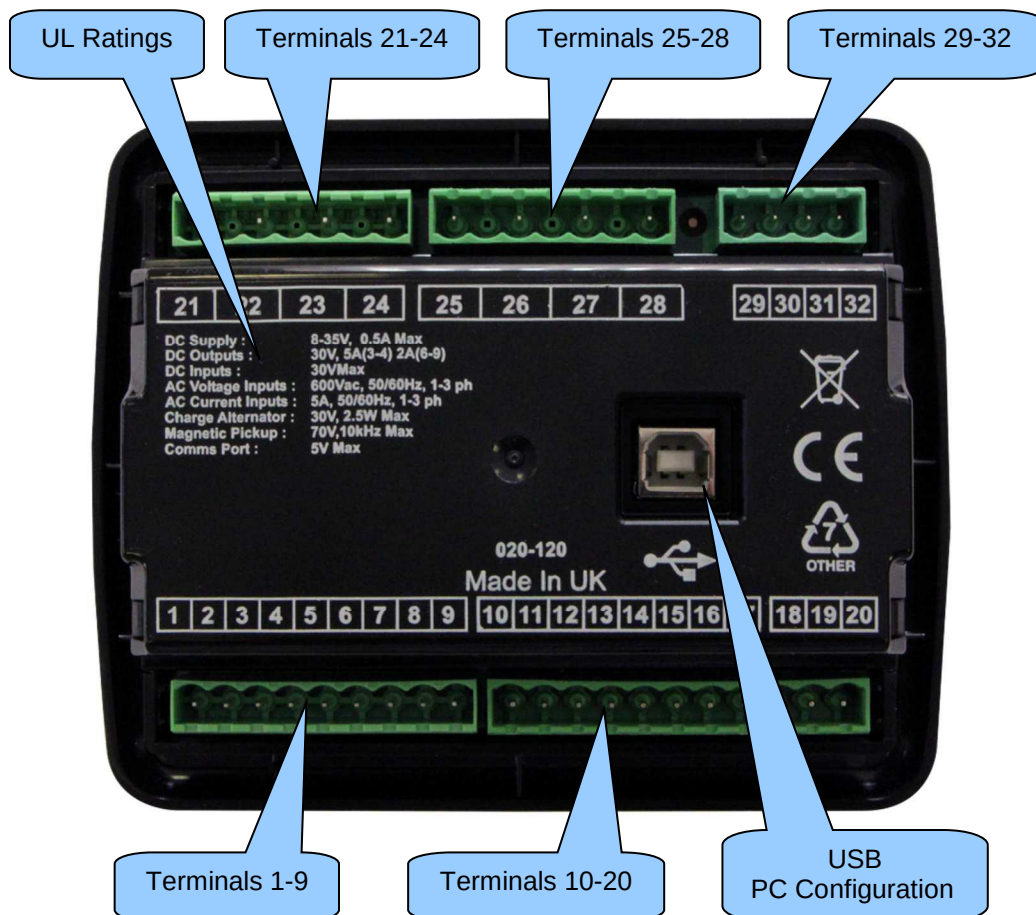
3 INSTALLATION

The module is designed to be mounted on the panel fascia. For dimension and mounting details, see the section entitled *Dimension and Mounting* elsewhere in this document.

3.1 USER CONNECTIONS

NOTE: Availability of some terminals depends upon module version. Full details are given in the section entitled *Terminal Description* elsewhere in this manual.

To aid user connection, icons are used on the rear of the module to help identify terminal functions. An example of this is shown below.



3.2 CONNECTION DESCRIPTIONS

3.2.1 DC SUPPLY, DC OUTPUTS & CHARGE FAIL INPUT

 **NOTE:** When the module is configured for operation with an electronic engine, *Fuel* and *Start* output requirements may be different. For further details on connection to electronic engines, refer to DSE Publication: **057-004 Electronic Engines And DSE Wiring**

 **NOTE:** For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual.**

Pin No	Description	Cable Size	Notes
1	DC Plant Supply Input (Negative)	2.5mm ² AWG 13	
2	DC Plant Supply Input (Positive)	2.5 mm ² AWG 13	Supplies the module and DC Outputs A, B, C, D, E & F
3	DC Output A (FUEL)	2.5mm ² AWG 13	Plant Supply Positive from terminal 2. 10 A for 10 seconds, 5 A resistive continuous Fixed as FUEL relay if electronic engine is not configured.
4	DC Output B (START)	2.5mm ² AWG 13	Plant Supply Positive from terminal 2. 10 A for 10 seconds, 5 A resistive continuous Fixed as START relay if electronic engine is not configured.
5	Charge Fail / Excite	2.5mm ² AWG 13	Do not connect to ground (battery negative). If charge alternator is not fitted, leave this terminal disconnected.
6	DC Output C	1.0mm ² AWG 18	2 Amp rated from module supply.
7	DC Output D	1.0mm ² AWG 18	2 Amp rated from module supply.
8	DC Output E	1.0mm ² AWG 18	2 Amp rated from module supply.
9	DC Output F	1.0mm ² AWG 18	2 Amp rated from module supply.



3.2.2 ANALOGUE SENSOR INPUTS

 **NOTE:** For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

 **NOTE:** It is VERY important that terminal 10 (sensor common) is connected to an earth point on the ENGINE BLOCK, not within the control panel, and must be a sound electrical connection to the sensor bodies. This connection **MUST NOT** be used to provide an earth connection for other terminals or devices. The simplest way to achieve this is to run a **SEPARATE** earth connection from the system earth star point, to terminal 10 directly, and not use this earth for other connections.

 **NOTE:** If PTFE insulating tape is used on the sensor thread when using earth return sensors, ensure not to insulate the entire thread, as this prevents the sensor body from being earthed via the engine block.

Pin No	Description	Cable Size	Notes
15	Sensor Common Return	0.5 mm ² AWG 20	Ground Return Feed For Sensors
16	Analogue Sensor Input A	0.5 mm ² AWG 20	Connect To Oil Pressure Sensor
17	Analogue Sensor Input B	0.5mm ² AWG 20	Connect To Coolant Temperature Sensor
18	Analogue Sensor Input C	0.5 mm ² AWG 20	Connect To Fuel Level Sensor or a Flexible Sensor



3.2.3 CONFIGURABLE DIGITAL INPUTS & CAN

NOTE: For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN link.
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for CAN use (DSE part number 016-030)

Pin No	Description	Cable Size	Notes
14	Configurable Digital Input A	0.5mm ² AWG 20	Switch to negative
15	Configurable Digital Input B	0.5mm ² AWG 20	Switch to negative
16	Configurable Digital Input C	0.5mm ² AWG 20	Switch to negative
17	Configurable Digital Input D	0.5mm ² AWG 20	Switch to negative
18	CAN Port H	0.5mm ² AWG 20	Use only 120 Ω CAN approved cable
19	CAN Port L	0.5mm ² AWG 20	Use only 120 Ω CAN approved cable
20	CAN Port Screen	Shield	Use only 120 Ω CAN approved cable



3.2.4 GENERATOR & MAINS VOLTAGE & FREQUENCY SENSING

NOTE: The below table describes connections to a three phase, four wire alternator. For alternative wiring topologies, see the section entitled *Alternate Topology Wiring Diagrams* elsewhere in this document.

NOTE: Terminals 25 to 28 are not fitted to DSE4510 MKII

Pin No	Description	Cable Size	Notes
21	Generator L1 (U) Voltage Sensing	1.0 mm ² AWG 18	Connect to Generator L1 (U) output (AC) (Recommend 2 A fuse)
22	Generator L2 (V) Voltage Sensing	1.0 mm ² AWG 18	Connect to Generator L2 (V) output (AC) (Recommend 2 A fuse)
23	Generator L3 (W) Voltage Sensing	1.0 mm ² AWG 18	Connect to Generator L3 (W) output (AC) (Recommend 2 A fuse)
24	Generator Neutral (N) Input	1.0 mm ² AWG 18	Connect to Generator Neutral terminal (AC)
25	Mains L1 (R) Voltage Monitoring	1.0mm ² AWG 18	Connect to Mains L1 (R) output (AC) (Recommend 2A fuse)
26	Mains L2 (S) Voltage Monitoring	1.0mm ² AWG 18	Connect to Mains L2 (S) output (AC) (Recommend 2A fuse)
27	Mains L3 (T) Voltage Monitoring	1.0mm ² AWG 18	Connect to Mains L3 (T) output (AC) (Recommend 2A fuse)
28	Mains Neutral (N) Input	1.0mm ² AWG 18	Connect to Mains Neutral terminal (AC)



3.2.5 CURRENT TRANSFORMERS



WARNING! Do not disconnect this plug when the CTs are carrying current. Disconnection open circuits the secondary of the C.T.'s and dangerous voltages may then develop. Always ensure the CTs are not carrying current and the CTs are short circuit connected before making or breaking connections to the module.



NOTE: The module has a burden of 0.25 VA on the CT. Ensure the CT is rated for the burden of the controller, the cable length being used and any other equipment sharing the CT. If in doubt, consult with the CT supplier.



NOTE: Take care to ensure correct polarity of the CT primary as shown below. If in doubt, consult with the CT supplier.

Pin No	Description	Cable Size	Notes
29	CT Secondary for L1	2.5mm ² AWG 13	Connect to s1 secondary of L1 monitoring CT
30	CT Secondary for L2	2.5mm ² AWG 13	Connect to s1 secondary of L2 monitoring CT
31	CT Secondary for L3	2.5mm ² AWG 13	Connect to s1 secondary of L3 monitoring CT
32	CT Common	2.5mm ² AWG 13	

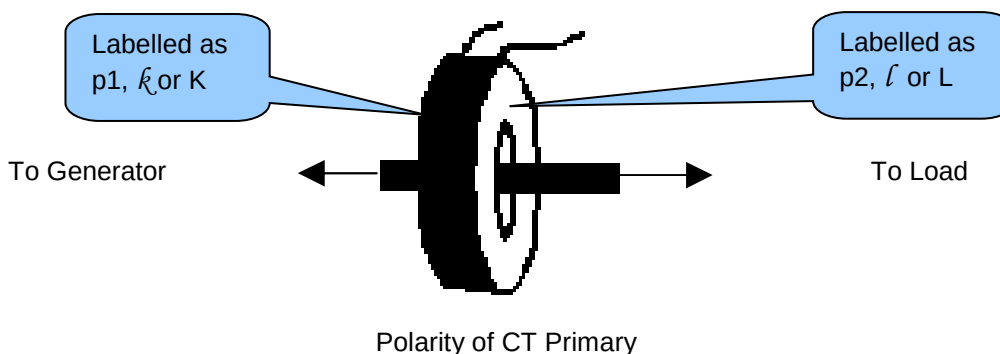
3.2.5.1 CT CONNECTIONS

p1, ℓ or K is the primary of the CT that 'points' towards the Generator

p2, ℓ or L is the primary of the CT that 'points' towards the Load

s1 is the secondary of the CT that connects to the DSE Module's input for the CT measuring

s2 is the secondary of the CT that should be commoned with the s2 connections of all the other CTs and connected to the CT common terminal of the module.



3.2.6 USB SLAVE (PC CONFIGURATION) CONNECTOR

NOTE: The USB connection cable between the PC and the module must not be extended beyond 5 m (yards). For distances over 5 m, it is possible to use a third party USB extender. Typically, they extend USB up to 50 m. The supply and support of this type of equipment is outside the scope of Deep Sea Electronics PLC.

CAUTION!: Care must be taken not to overload the PCs USB system by connecting more than the recommended number of USB devices to the PC. For further information, consult your PC supplier.

NOTE: For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

	Description	Cable Size	Notes
	Socket for connection to PC with DSE Configuration Suite Software	0.5 mm ² AWG 20	This is a standard USB type A to type B connector. 



3.3 TYPICAL WIRING DIAGRAM

As every system has different requirements, these diagrams show only a typical system and do not intend to show a complete system.

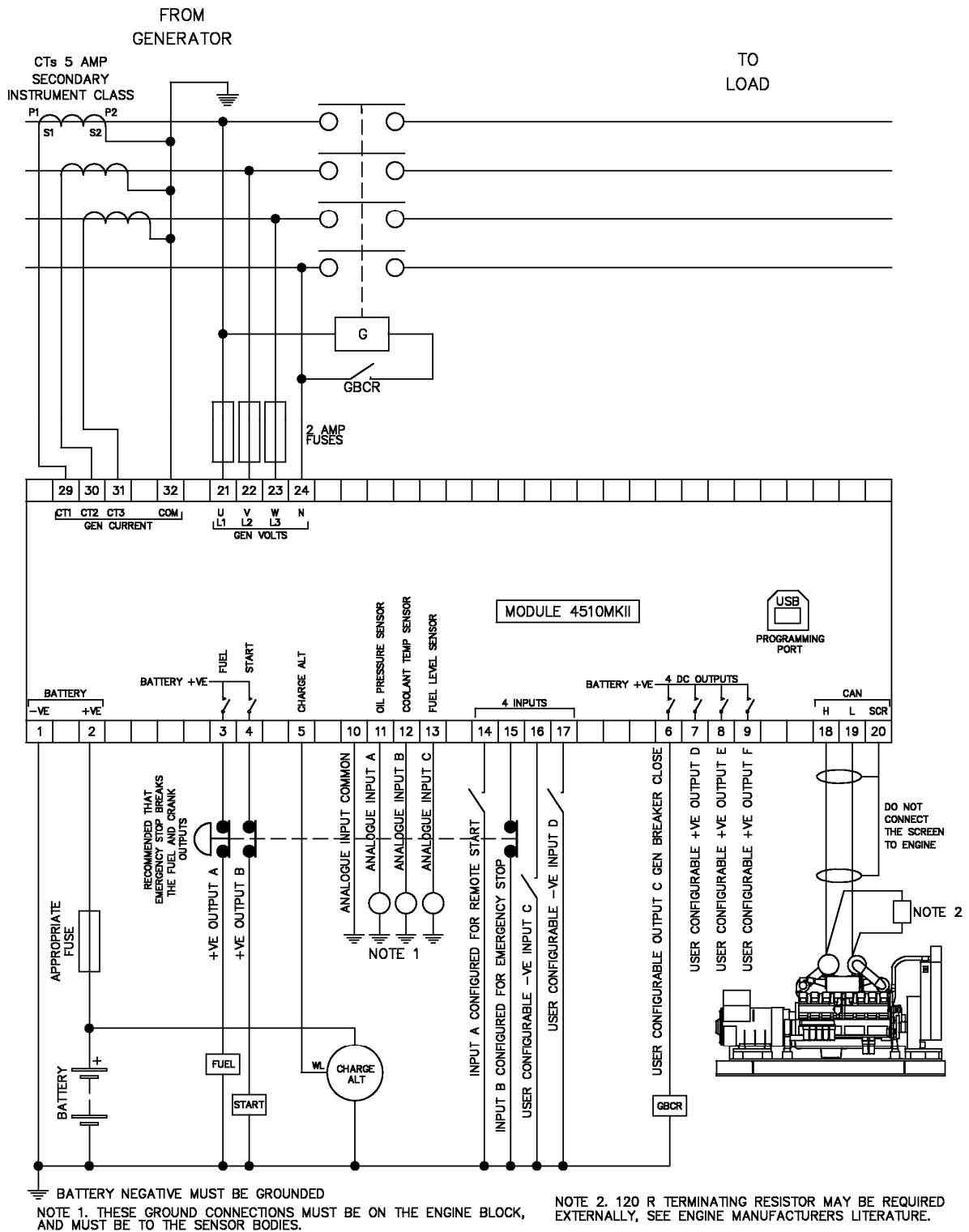
Genset manufacturers and panel builders may use these diagrams as a starting point; however always refer to the completed system diagram provided by the system manufacturer for complete wiring detail.

Further wiring suggestions are available in the following DSE publications, available at www.deepseapl.com to website members.

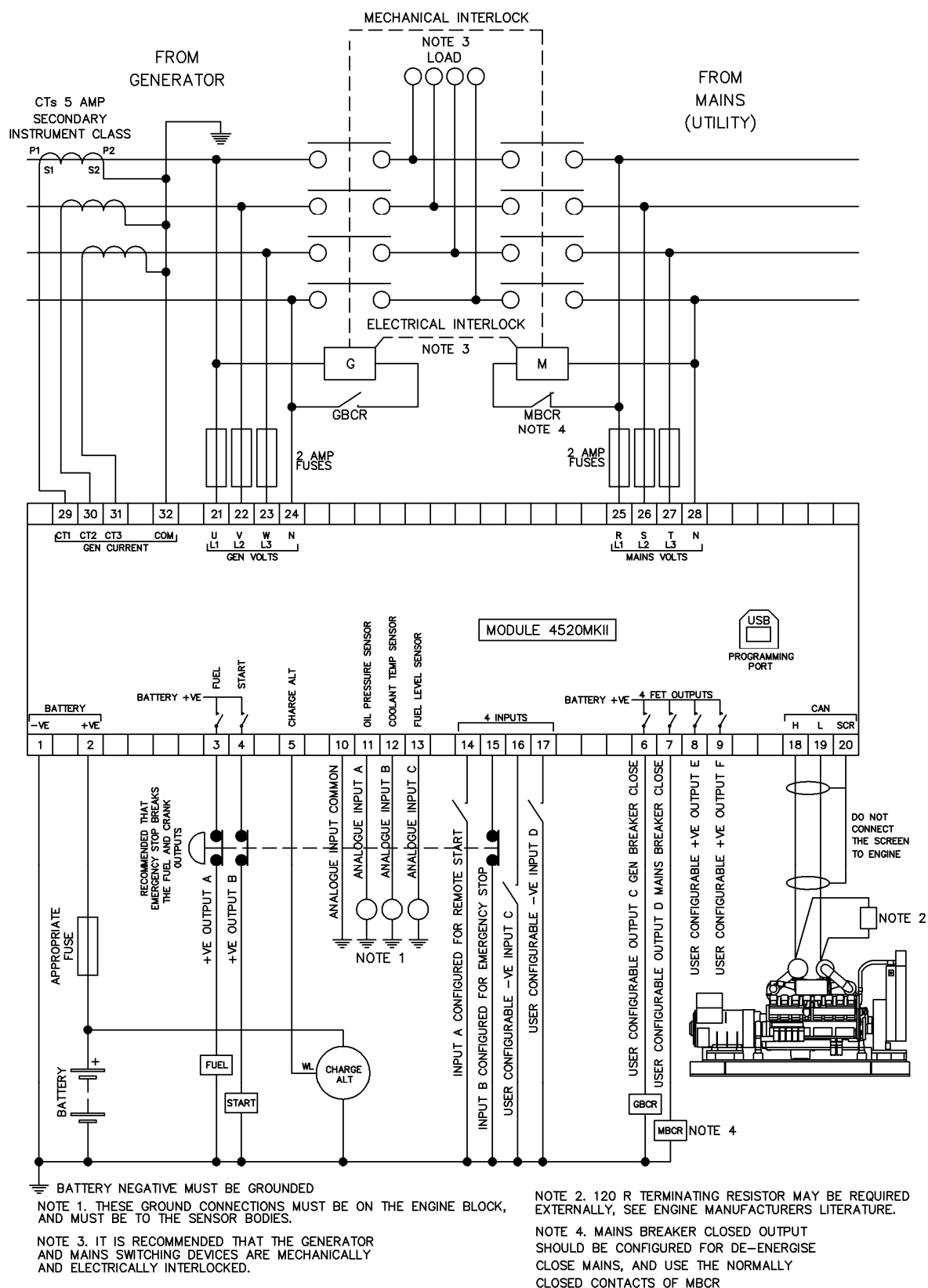
DSE Part	Description
056-022	Breaker Control (Training guide)
057-004	Electronic Engines and DSE Wiring



3.3.1 DSE4510 MKII TYPICAL WIRING DIAGRAM (3 PHASE 4 WIRE)



3.3.2 DSE4520 MKII TYPICAL WIRING DIAGRAM (3 PHASE 4 WIRE)



3.3.3 EARTH SYSTEMS

3.3.3.1 NEGATIVE EARTH

The typical wiring diagrams located within this document show connections for a negative earth system (the battery negative connects to Earth).

3.3.3.2 POSITIVE EARTH

When using a DSE module with a Positive Earth System (the battery positive connects to Earth), the following points must be followed:

Follow the typical wiring diagram as normal for all sections **except** the earth points.
All points shown as Earth on the typical wiring diagram should connect to **battery negative** (not earth).

3.3.3.3 FLOATING EARTH

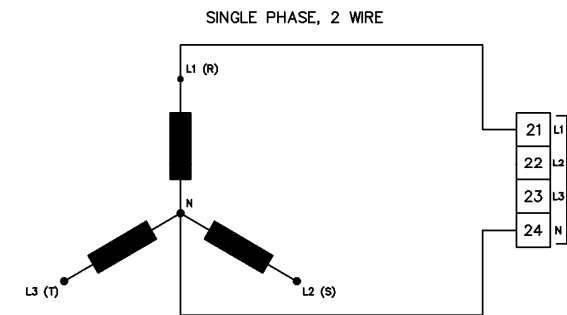
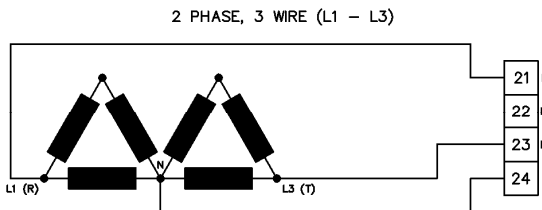
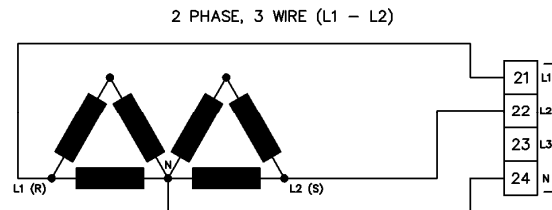
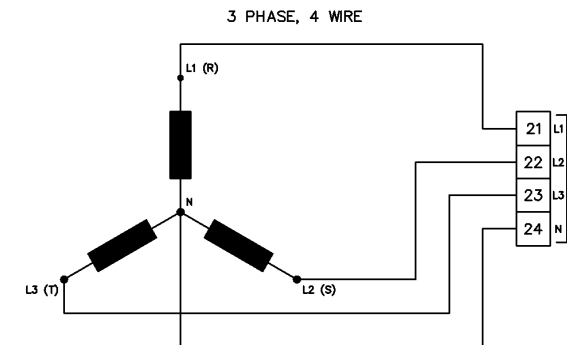
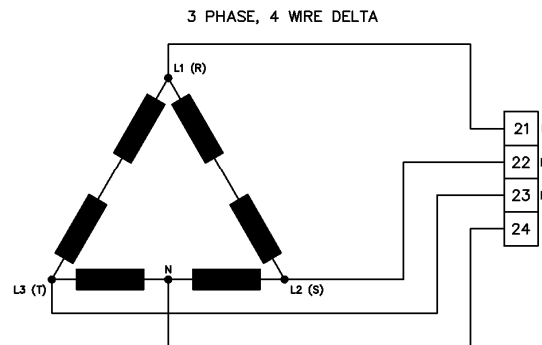
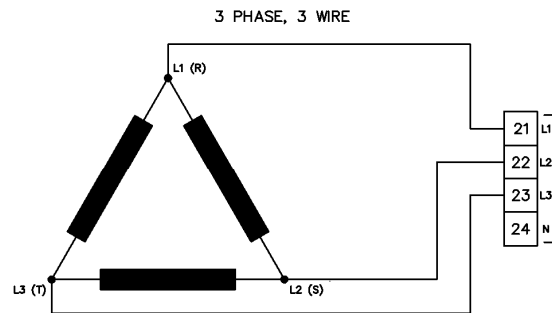
Where neither the battery positive nor battery negative terminals are connected to earth the following points must to be followed:

Follow the typical wiring diagram as normal for all sections **except** the earth points.
All points shown as Earth on the typical wiring diagram should connect to **battery negative** (not earth).

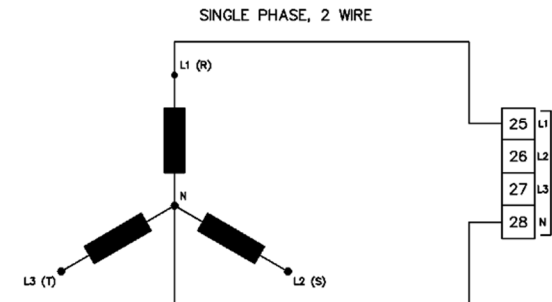
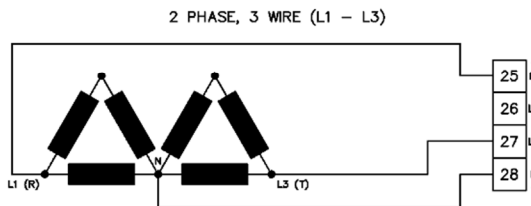
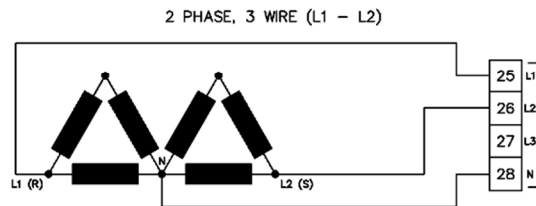
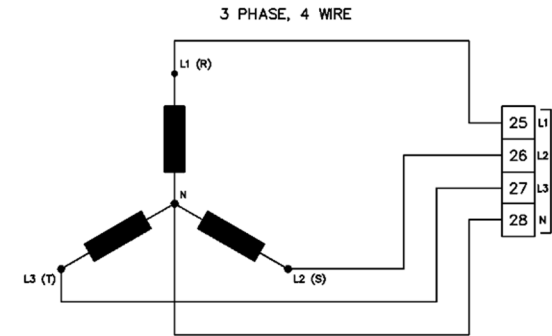
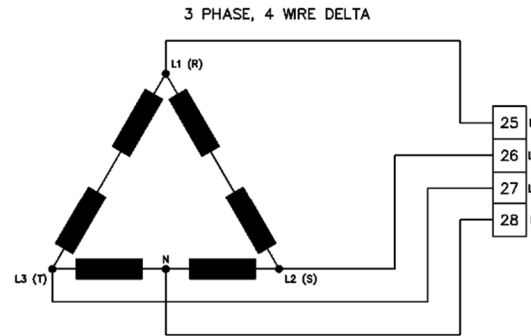
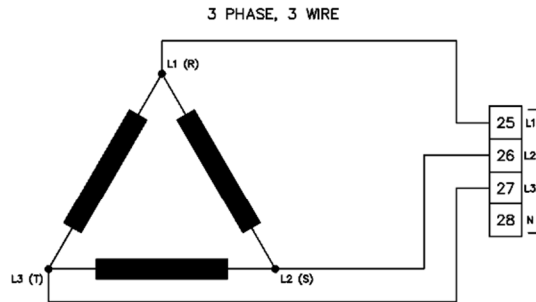


3.4 ALTERNATE TOPOLOGY WIRING DIAGRAMS

3.4.1 GENERATOR



3.4.2 MAINS (DSE4520 MKII ONLY)



4 DESCRIPTION OF CONTROLS



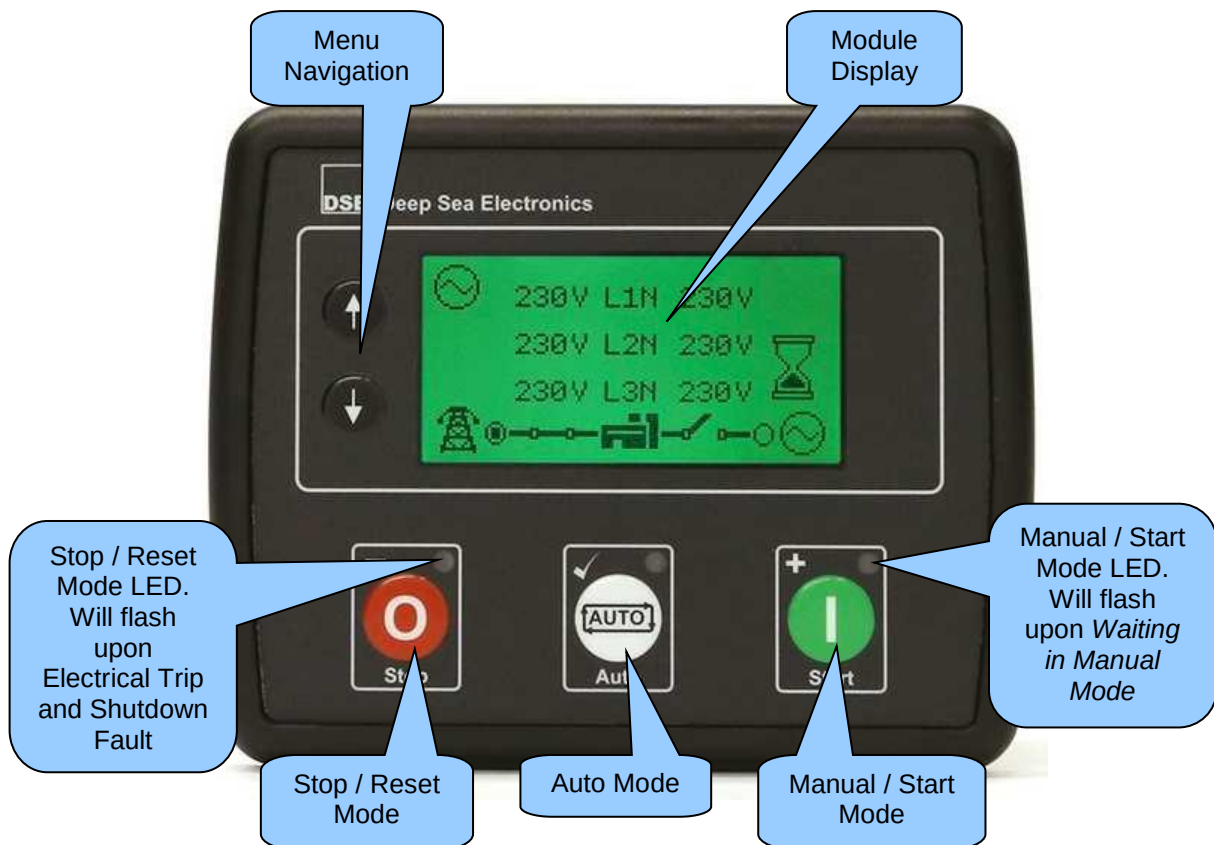
CAUTION: The module may instruct an engine start event due to external influences. Therefore, it is possible for the engine to start at any time without warning. Prior to performing any maintenance on the system, it is recommended that steps are taken to remove the battery and isolate supplies.



NOTE: The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

Control of the module is via push buttons mounted on the front of the module with

Stop/Reset Mode , **Auto Mode**  and **Manual/Start Mode**  functions. For normal operation, these are the only controls which need to be operated. Details of their operation are provided later in this document.



4.1 CONTROL PUSH BUTTONS



NOTE: For further details, see section entitled *Operation* elsewhere in this manual.

Icon	Description
	Stop / Reset Mode This button places the module into its Stop/Reset Mode . This clears any alarm conditions for which the triggering criteria has been removed. If the engine is running and the module is put into Stop/Reset Mode , the module automatically instructs the generator off load ('Close Generator Output' becomes inactive (if used)) and place the mains on load ('Close Mains Output' becomes active (if used on DSE4520 MKII)). The fuel supply de-energises and the engine comes to a standstill. Should any form of <i>start signal</i> be present when in Stop/Reset Mode  the generator remains at rest. For further details, see the more detailed section of <i>Operation</i> elsewhere in this manual.
	Auto Mode This button places the module into its Auto Mode . This mode allows the module to control the function of the generator automatically. The module monitors numerous start requests and when one has been made, the set is automatically started. Once the generator is available, the mains is taken off load ('Close Mains Output' becomes inactive (if used on DSE4520 MKII)) and the generator is placed on load ('Close Generator Output' becomes active (if used) and 'Delayed Load Output 1, 2, 3 & 4' becomes active (if used)). Upon removal of the starting signal, the module starts the <i>Return Delay Timer</i> and once expired, takes the generator off load ('Close Generator Output' becomes inactive (if used) and 'Delayed Load Output 1, 2, 3 & 4' becomes inactive (if used)) and places the mains on load ('Close Mains Output' becomes active (if used on DSE4520 MKII)). The generator then continues to run for the duration of the <i>Cooling Timer</i> until it stops. The module then waits for the next start event. For further details, see the more detailed section of <i>Operation</i> elsewhere in this manual.





NOTE: For further details, see section entitled *Operation* elsewhere in this manual.

Icon	Description
	Manual/Start Mode This button starts the generator and runs it off load. To place the generator on load digital inputs are required to provide the loading/unloading instruction. If the engine is running off-load in Manual/Start Mode  and a <i>Remote Start Signal</i> becomes present, the module automatically instructs the changeover device to take the mains off load ('Close Mains Output' becomes <i>inactive (if used on DSE4520 MKII)</i>) and place the generator on load ('Close Generator Output' becomes <i>active (if used)</i> and 'Delayed Load Output 1, 2, 3 & 4' becomes <i>active (if used)</i>). Upon removal of the <i>Remote Start Signal</i>, the generator remains on load until Stop/Reset Mode  or Auto Mode  are selected. For further details, see the more detailed section of <i>Operation</i> elsewhere in this manual.
	Menu Navigation Used for navigating the instrumentation, event log and configuration screens.



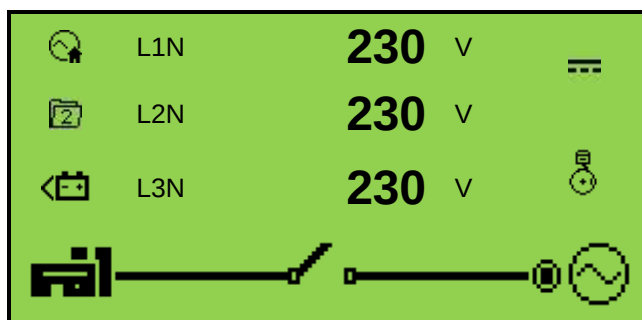
4.2 MODULE DISPLAY

The module's display contains the following sections. Description of each section can be viewed in the sub sections.

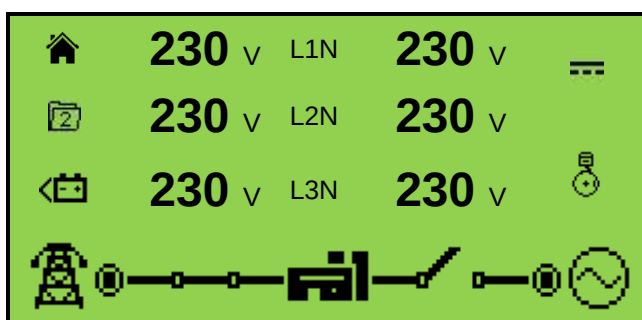
NOTE: Depending upon the module's configuration, some display screens may be disabled. For further details of module configuration, refer to DSE Publication: 057-258 *DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

<i>Inst. Icon</i>	Instrumentation	Unit	<i>Alarm Icon</i>
<i>Active Config</i>	Instrumentation	Unit	
<i>FPE / Auto Run</i>	Instrumentation	Unit	<i>Mode Icon</i>
<i>Load Switching Icons</i>			

Example of DSE4510 MKII Home Page Display



Example of DSE4520 MKII Home Page Display



4.2.1 INSTRUMENTATION ICONS

When viewing instrumentation pages, an icon is displayed in the **Inst. Icon** section to indicate what section is currently being displayed.

Icon	Details
	The default home page which displays generator voltage and mains voltage (DSE4520 MKII only) or engine tier 4 information
	Generator and mains voltage (DSE4520 MKII only)
	Generator voltage and frequency instrumentation screen
	Mains voltage and frequency instrumentation screen (DSE4520 MKII only)
	Generator current instrumentation screen
	Mains current instrumentation screen (DSE4520 MKII only when CT in load location)
	Load power instrumentation screen
	Engine speed instrumentation screen
	Hours run instrumentation screen
	Battery voltage instrumentation screen
	Oil pressure instrumentation screen
	Coolant temperature instrumentation screen
	Flexible sensor instrumentation screen
	Appears when the event log is being displayed
	Current time held in the unit
	The current value of the scheduler run time and duration
	ECU diagnostic trouble codes
	Oil filter maintenance timers
	Air filter maintenance timers
	Fuel filter maintenance timers
	Engine oil temperature (measured from CAN) instrumentation screen
	Inlet manifold temperature (measured from CAN) instrumentation screen
	Exhaust temperature 1 (measured from CAN) instrumentation screen
	Exhaust temperature 2 (measured from CAN) instrumentation screen
	Coolant pressure 1 (measured from CAN) instrumentation screen
	Coolant pressure 2 (measured from CAN) instrumentation screen

Continued overleaf...



Description of Controls

Icon	Details
	Turbo pressure 1 (measured from CAN) instrumentation screen
	Turbo pressure 2 (measured from CAN) instrumentation screen
	Fuel consumption (measured from CAN) instrumentation screen
	Fuel pressure (measured from CAN) instrumentation screen
	Total fuel used (measured from CAN) instrumentation screen
	Soot level as a percentage (measured from CAN) instrumentation screen
	Ash level as a % (measured from CAN) instrumentation screen
	DEF tank level (measured from CAN) instrumentation screen
	DEF fluid temperature (measured from CAN) instrumentation screen
	DEF consumption (measured from CAN) instrumentation screen
	String of text for DEF inducement reason (taken from CAN)
	String of text for DEF inducement severity (taken from CAN)
	EGR pressure (measured from CAN) instrumentation screen
	EGR temperature (measured from CAN) instrumentation screen
	Ambient air temperature (measured from CAN) instrumentation screen
	Air intake temperature (measured from CAN) instrumentation screen



4.2.2 ACTIVE CONFIGURATION

An icon is displayed in the **Active Config** section to indicate the active configuration within the currently selected within the controller.

Icon	Details
	Appears when the main configuration is selected.
	Appears when the alternative configuration 1 is selected.
	Appears when the alternative configuration 2 is selected.
	Appears when the alternative configuration 3 is selected.

4.2.3 FRONT PANEL EDITOR (FPE) / AUTO RUN ICON

NOTE: For further details about the Front Panel Editor, see the section entitled 'Front Panel Editor' elsewhere in this manual.

When running in Auto Mode and on the Home () page, an icon is displayed in the **FPE / Auto Run** section to indicate the source of the auto start signal.

Icon	Auto Run Reason
	Appears when a remote start input is active
	Appears when a low battery run is active
	Mains failure
	Appears when a scheduled run is active

4.2.4 MODE ICON

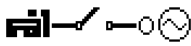
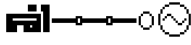
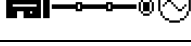
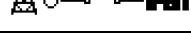
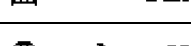
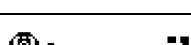
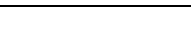
An icon is displayed in the **Mode Icon** section to indicate the mode the controller is currently in.

Icon	Details
	Appears when the engine is at rest and the unit is in stop mode.
	Appears when the engine is at rest and the unit is in auto mode.
	Appears when the engine is at rest and the unit is waiting for a manual start.
	Appears when a timer is active, for example cranking time, crank rest etc.
	Appears when the engine is running, and all timers have expired, either on or off load. The animation speed is reduced when running in idle mode.
	Appears when the unit is in the front panel editor.



4.2.5 LOAD SWITCHING ICON

An icon is displayed in the **Load Switching Icon** section to indicate the current operation status of the controller.

Icon	Details
	Appears when the generator is at rest or not available and when the generator breaker is open.
	Appears when the generator is at rest or not available and the generator breaker has failed to open.
	Appears when the generator is available and the generator breaker is open.
	Appears when the generator is available and the generator breaker is closed.
	Appears when the mains supply is not available and the mains breaker is open. (DSE4520 MKII Only)
	Appears when the mains supply is not available and the mains breaker is closed. (DSE4520 MKII Only)
	Appears when the mains supply is available and the mains breaker is open. (DSE4520 MKII Only)
	Appears when the mains supply is available and the mains breaker is closed. (DSE4520 MKII Only)

4.2.6 SPLASH SCREEN

An icon is displayed across the entire screen to indicate the when the configuration of the module is changed.

Icon	Details
	Appears when a USB connection is made to the controller.
	Appears if either the configuration file or engine file becomes corrupted.

4.2.7 BACKLIGHT

The LCD backlight is on if the unit has sufficient voltage while the unit is turned on, unless the unit is cranking for which the backlight is turned off.



4.2.8 ALARM ICONS (PROTECTIONS)

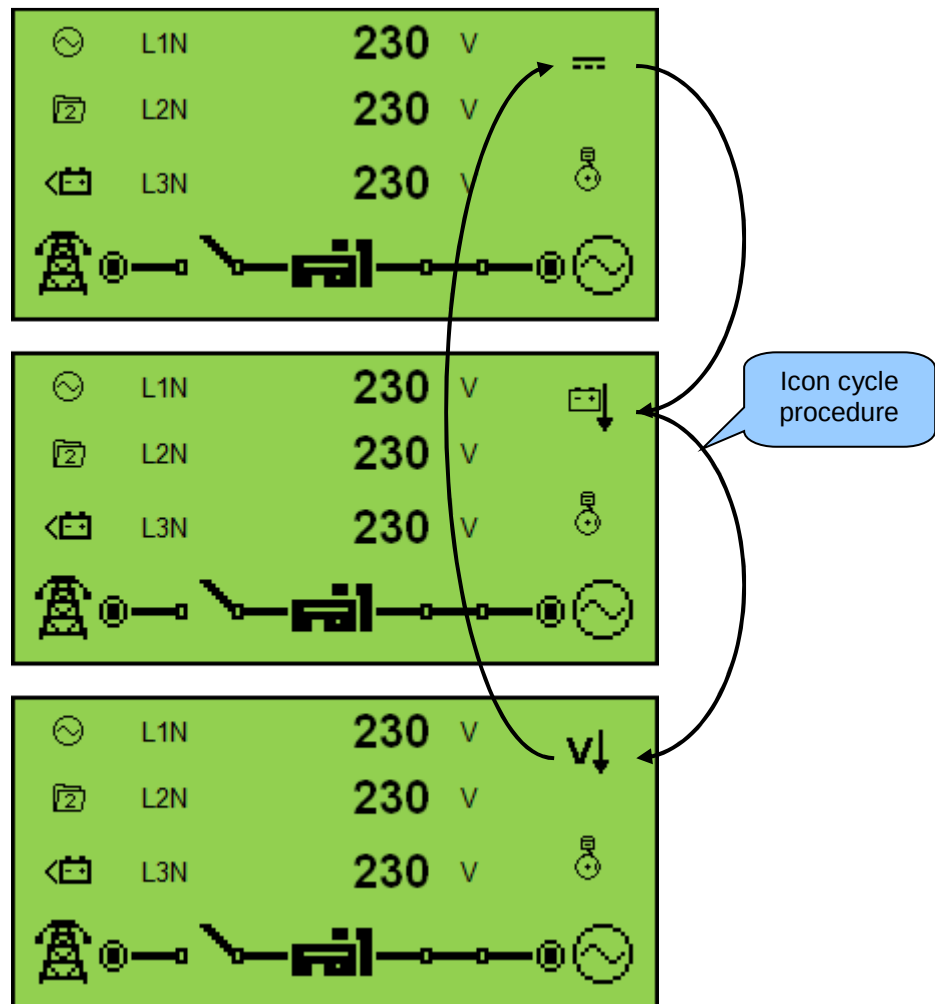
An icon is displayed in the **Alarm Icon** section to indicate the alarm that is current active on the controller.

In the event of a warning alarm, the LCD only displays the **Alarm Icon**. In the event of an electrical trip or shutdown alarm, the module displays the **Alarm Icon** and the **Stop/Reset Mode**  button LED begins to flash.

If multiple alarms are active at the same time, the **Alarm Icon** automatically cycles through all the appropriate icons to indicate each alarm which is active.

Example:

If the DSE controller was sensing a charge alternator failure alarm, delay over current alarm and a AC under voltage alarm at the same time, it would cycle through all of the icons to show this.



4.2.8.1 WARNING ALARM ICONS

Warnings are non-critical alarm conditions and do not affect the operation of the engine system, they serve to draw the operators attention to an undesirable condition.

By default, warning alarms are self-resetting when the fault condition is removed. However enabling *All Warnings Are Latched* causes warning alarms to latch until reset manually. This is enabled using the DSE Configuration Suite in conjunction with a compatible PC.

Icon	Fault	Description
	Auxiliary Inputs	The module detects that an auxiliary input which has been user configured to create a fault condition has become active.
	Analogue Input Configured As Digital	The analogue inputs can be configured to digital inputs. The module detects that an input configured to create a fault condition has become active.
	Fail To Stop	The module has detected a condition that indicates that the engine is running when it has been instructed to stop. NOTE: 'Fail to Stop' could indicate a faulty oil pressure sensor. If engine is at rest check oil sensor wiring and configuration.
	Charge Failure	The auxiliary charge alternator voltage is low as measured from the W/L terminal.
	Low Fuel Level	The level detected by the fuel level sensor is below the low fuel level pre-set pre-alarm setting.
	High Fuel Level	The level detected by the fuel level sensor is above the high fuel level pre-set pre-alarm setting.
	Battery Under Voltage	The DC supply has fallen below or risen above the low volts pre-set pre-alarm setting.
	Battery Over Voltage	The DC supply has risen above the high volts pre-set pre-alarm setting.
	Generator Under Voltage	The generator output voltage has fallen below the pre-set pre-alarm setting after the Safety On timer has expired.
	Generator Over Voltage	The generator output voltage has risen above the pre-set pre-alarm setting.
	Generator Under Frequency	The generator output frequency has fallen below the pre-set pre-alarm setting after the Safety On timer has expired.
	Generator Over Frequency	The generator output frequency has risen above the pre-set pre-alarm setting.
	CAN ECU Fault	The engine ECU has detected an alarm
	CAN Data Fail	The module is configured for CAN operation and does not detect data on the engine Can data link.
	Immediate Over Current	The measured current has risen above the configured trip level.
	Delayed Over Current	The measured current has risen above the configured trip level for a configured duration.

Continued overleaf...



Description of Controls

Icon	Fault	Description
	Oil Filter Maintenance Alarm	Maintenance due for oil filter.
	Air Filter Maintenance Alarm	Maintenance due for air filter
	Fuel Filter Maintenance Alarm	Maintenance due for fuel filter.
	Water In Fuel	The engine ECU has detected there is water in the fuel.
	DPTC Filter	The engine ECU has detected that the DPTC Filter is active
	HEST Active	The engine ECU has detected that exhaust gas recirculation temperature is high.
	DEF Level	The engine ECU has detected that the DEF level is low.
	SCR Inducement	The engine ECU has detected that the SCR inducement is active



4.2.8.2 ELECTRICAL TRIP ALARM ICONS

 **NOTE:** The fault condition must be resolved before the alarm can be reset. If the fault condition remains, it is not possible to reset the alarm (the exception to this is the *Coolant Temp High* alarm and similar *Active From Safety On* alarms, as the coolant temperature could be high with the engine at rest).

Electrical Trip Alarms are latching and stop the Generator but in a controlled manner. On initiation of the electrical trip condition the module de-activates the **Close Gen Output** outputs to remove the load from the generator. Once this has occurred the module starts the *Cooling Timer* and allows the engine to cool off-load before shutting down the engine. To restart the generator the fault must be cleared and the alarm reset.

Electrical Trip Alarms are latching alarms and to remove the fault, press the **Stop/Reset Mode**  button on the module.

Icon	Fault	Description
	Auxiliary Inputs	The module detects that an auxiliary input which has been user configured to create a fault condition has become active.
	Analogue Input Configured As Digital	The analogue inputs can be configured to digital inputs. The module detects that an input configured to create a fault condition has become active.
	Low Fuel Level	The level detected by the fuel level sensor is below the low fuel level pre-set alarm setting.
	High Fuel Level	The level detected by the fuel level sensor is above the high fuel level pre-set alarm setting.
	Delayed Over Current	The measured current has risen above the configured trip level for a configured duration.
	kW Overload	The measured kW has risen above the configured trip level for a configured duration.
	Water In Fuel	The engine ECU has detected there is water in the fuel.
	DPTC Filter	The engine ECU has detected that the DPTC Filter is active
	DEF Level	The engine ECU has detected that the DEF level is low.
	SCR Inducement	The engine ECU has detected that the SCR inducement is active



4.2.8.3 SHUTDOWN ALARM ICONS

 **NOTE:** The fault condition must be resolved before the alarm can be reset. If the fault condition remains, it is not possible to reset the alarm (the exception to this is the *Oil Pressure Low* alarm and similar *Active From Safety On* alarms, as the oil pressure is low with the engine at rest).

Shutdown Alarms are latching and immediately stop the Generator. On initiation of the shutdown condition the module de-activates the **Close Gen Output** outputs to remove the load from the generator. Once this has occurred, the module shuts the generator set down immediately to prevent further damage. To restart the generator the fault must be cleared and the alarm reset.

Shutdown Alarms are latching alarms and to remove the fault, press the **Stop/Reset Mode**  button on the module.

Icon	Fault	Description
	Auxiliary Inputs	The module detects that an auxiliary input which has been user configured to create a fault condition has become active.
	Analogue Input Configured As Digital	The analogue inputs can be configured to digital inputs. The module detects that an input configured to create a fault condition has become active.
	Fail To Start	The engine has failed to start after the configured number of start attempts
	Low Oil Pressure	The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the Safety On timer has expired.
	Engine High Temperature	The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the Safety On timer has expired.
	Under Speed	The engine speed has fallen below the under speed pre alarm setting
	Over Speed	The engine speed has risen above the over speed pre alarm setting
	Charge Failure	The auxiliary charge alternator voltage is low as measured from the W/L terminal.
	Low Fuel Level	The level detected by the fuel level sensor is below the low fuel level pre-set alarm setting.
	High Fuel Level	The level detected by the fuel level sensor is above the high fuel level pre-set alarm setting.
	Generator Under Voltage	The generator output voltage has fallen below the pre-set alarm setting after the Safety On timer has expired.
	Generator Over Voltage	The generator output voltage has risen above the pre-set alarm setting.

Continued overleaf...



Description of Controls

Icon	Fault	Description
	Generator Under Frequency	The generator output frequency has fallen below the pre-set alarm setting after the Safety On timer has expired.
	Generator Over Frequency	The generator output frequency has risen above the pre-set alarm setting.
	Delayed Over Current	The measured current has risen above the configured trip level for a configured duration.
	kW Overload	The measured kW has risen above the configured trip level for a configured duration.
	CAN ECU Fault	The engine ECU has detected an alarm – CHECK ENGINE LIGHT Contact Engine Manufacturer for support.
	CAN Data Fail	The module is configured for CAN operation and does not detect data on the engine Can data link.
	Emergency Stop	The emergency stop button has been depressed. This failsafe (normally closed to emergency stop) input and immediately stops the set should the signal be removed.
	Oil Sender Open Circuit	The oil pressure sensor has been detected as being open circuit.
	Coolant Temperature Sender Open Circuit	The coolant temperature sensor has been detected as being open circuit.
	Oil Filter Maintenance Alarm	Maintenance due for oil filter.
	Air Filter Maintenance Alarm	Maintenance due for air filter
	Fuel Filter Maintenance Alarm	Maintenance due for fuel filter.
	Water In Fuel	The engine ECU has detected there is water in the fuel.
	DPTC Filter	The engine ECU has detected that the DPTC Filter is active
	DEF Level	The engine ECU has detected that the DEF level is low.
	SCR Inducement	The engine ECU has detected that the SCR inducement is active



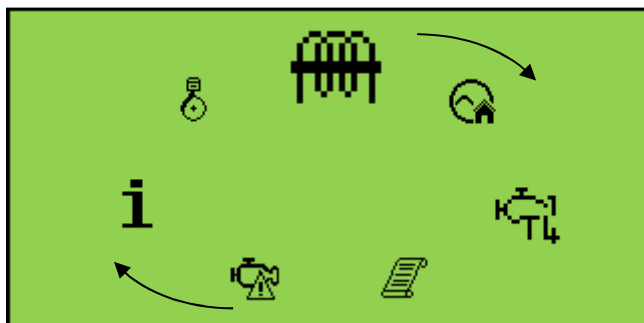
4.3 VIEWING THE INSTRUMENT PAGES

4.3.1 NAVIGATION MENU

To enter the navigation menu, press both the  (up) and  (down) buttons simultaneously.



To select the required icon, press the  (up) button to cycle right or the  (down) button to cycle left until the desired instrumentation section is reached.



Once the desired icon is at the top, press the **Auto Mode**  (✓) button to enter that instrumentation section. If the **Auto Mode**  (✓) button is not pressed, the display automatically returns to the Home  page after the configured setting of the *LCD Scroll Timer*.



4.3.1.1 NAVIGATION MENU ICONS

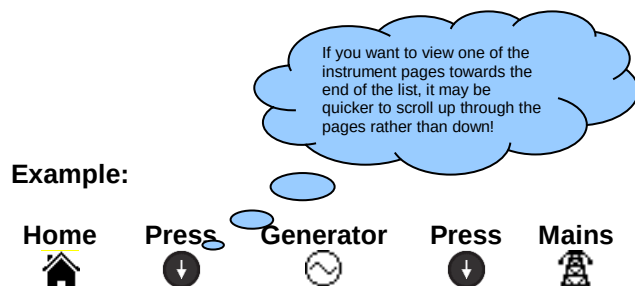
Icon	Description
	Home page (either engine tier 4 or generator and voltage instrumentation, depending upon module configuration)
	Generator and mains voltage instrumentation
	Generator instrumentation
	Mains instrumentation (DSE4520 MKII only)
	Mains load instrumentation
	Current and load instrumentation
	Engine instrumentation
	Module information
	Engine DTCs (Diagnostic Trouble Codes) if active
	Event Log
	Engine Tier 4 information



4.3.2 GENERAL NAVIGATION

NOTE: For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual.**

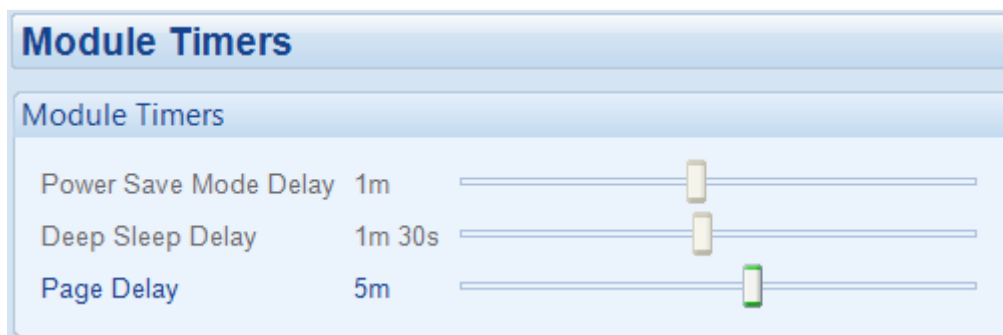
It is possible to scroll through the display to view different pages of information by repeatedly operating the up  or down  navigation buttons.



And so on until the last page is reached.
A Further press of the down  button returns the display to the Home (/) page.

Once selected, the page will remain on the LCD display until the user selects a different page or, after an extended period of inactivity (*Page Delay Timer*), the module reverts back to the Home (/) page.

The *Page Delay Timer* is configurable using the DSE Configuration Suite Software or by using the Front Panel Editor.

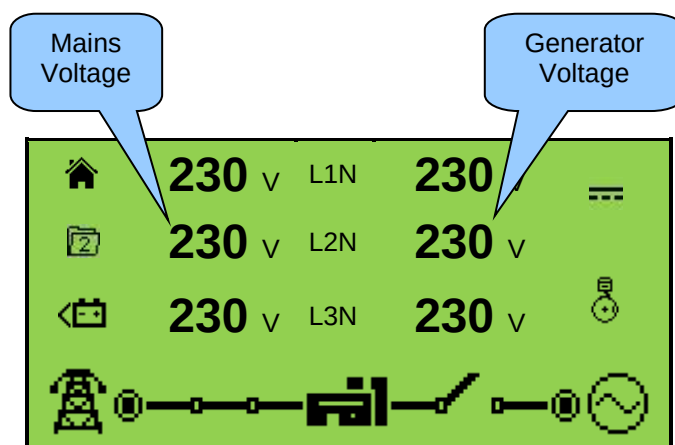


4.3.3 HOME

NOTE: Depending upon the module's configuration, the home screen may be set to display electrical parameters or engine tier 4 information. For further details of module configuration, refer to DSE Publication: 057-258 *DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

This is the page that is displayed when no other page has been selected and is automatically displayed after a period of inactivity (*Page Delay Timer*) of the module facia buttons. Depending upon configuration, the page contains the voltage reading of the generator and mains that is measured from the module's voltage inputs or engine tier 4 information read from the CAN.

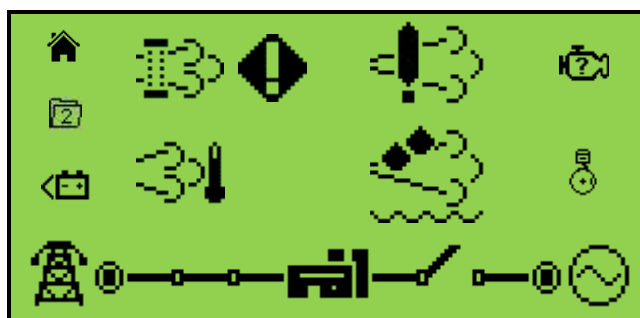
4.3.3.1 VOLTAGE INSTRUMENTATION



- Generator Voltage (ph-N / ph-ph)
- Mains Voltage (ph-N / ph-ph) (DSE4520 only)

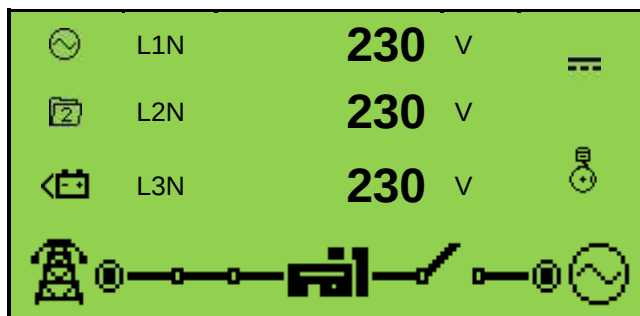
4.3.3.2 ENGINE TIER 4 INSTRUMENTATION

NOTE: For more information on the engine tier 4 icons, refer to the section entitled *Engine Tier 4 Information* else where in this manual.



4.3.4 GENERATOR

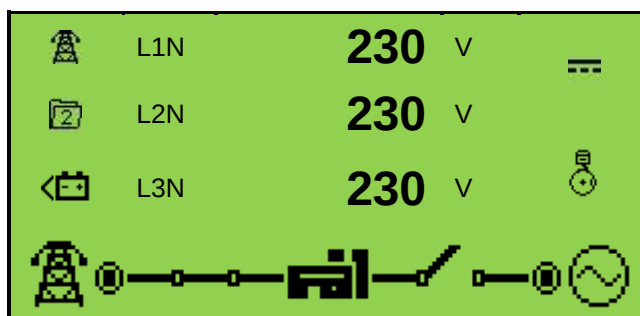
These pages contain electrical values of the generator, measured or derived from the module's voltage inputs.



- Generator Voltage (ph-N)
- Generator Voltage (ph-ph)
- Generator Frequency

4.3.5 MAINS (DSE4520 MKII ONLY)

These pages contain electrical values of the mains, measured or derived from the module's voltage inputs.

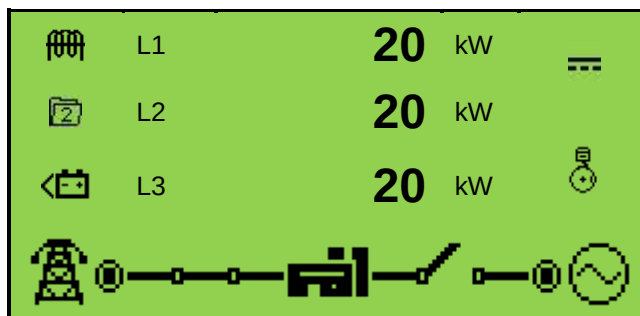


- Mains Voltage (ph-N)
- Mains Voltage (ph-ph)
- Mains Frequency



4.3.6 LOAD

These pages contain electrical values of the load, measured or derived from the module's voltage and current inputs. The power values displayed depend on which supply is on load.



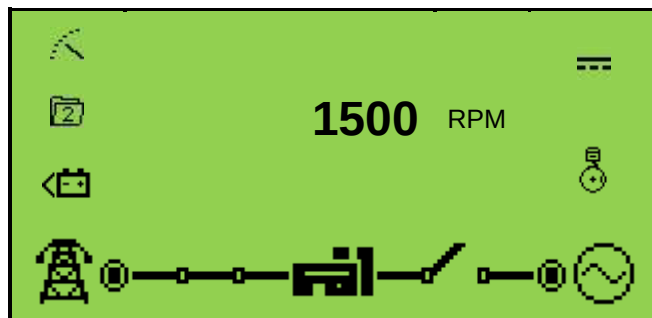
- Generator Current (A)
- Mains Current (A) (DSE4520 MKII only)
- Load ph-N (kW)
- Total Load (kW)
- Load ph-N (kVA)
- Total Load (kVA)
- Load ph-N (kVAR)
- Total Load (kVAR)
- Power Factor ph-N
- Power Factor Average
- Accumulated Load (kWh, kVAh, kVArh)



4.3.7 ENGINE

NOTE*: For further details of supported engine instrumentation from CAN, refer to DSE Publication: **057-004 Electronic Engines and DSE Wiring Guide**.

These pages contain instrumentation gathered about the engine measured or derived from the module's inputs, some of which may be obtained from the engine ECU.

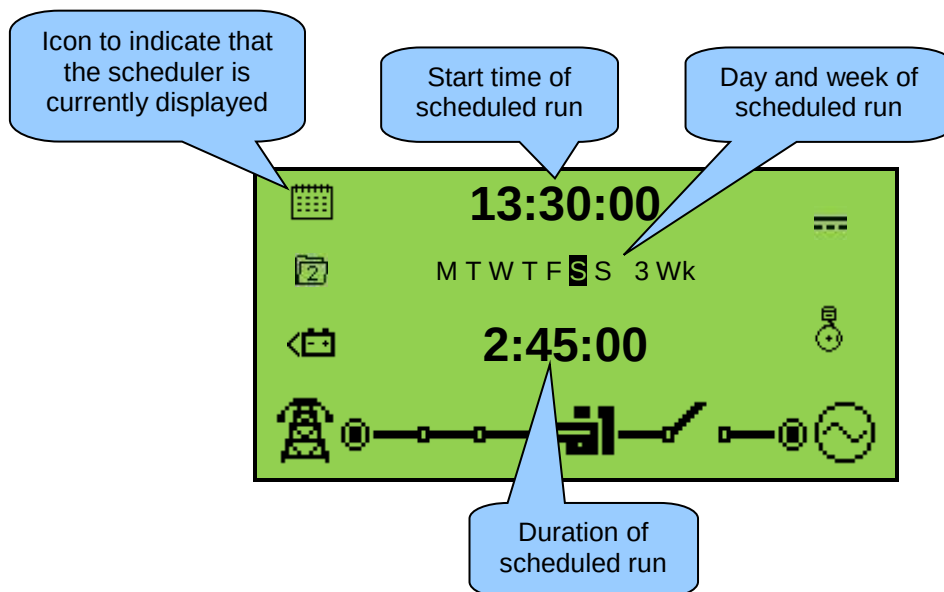


- Engine Speed
- Engine Run Time
- Engine Battery Voltage
- Engine Charge Alternator Voltage
- Engine Coolant Temperature
- Engine Oil Pressure
- Engine Fuel Level or Flexible Sensor
- Engine Oil Temperature*
- Inlet Manifold Temperature*
- Exhaust Temperature 1*
- Exhaust Temperature 2*
- Coolant Pressure 1*
- Coolant Pressure 2*
- Turbo Pressure 1*
- Turbo Pressure 2*
- Fuel Consumption*
- Fuel Pressure*
- Total Fuel Used*
- Soot Level*
- Ash Level*
- DEF Level*
- DEF Temperature*
- DEF Consumption*
- DEF Inducement Reason*
- DEF Inducement Severity*
- EGR Pressure*
- EGR Temperature*
- Ambient Air Temp*
- Air Intake Temp*
- Engine Maintenance Due – Oil
- Engine Maintenance Due – Air
- Engine Maintenance Due – Fuel



4.3.8 INFO

These pages contain information about the controller.



- Module's date and time
- Scheduler settings
- Product description and USB identification number
- Application and Engine Version



4.3.9 ENGINE DTC (ECU ALARMS)

If the DSE module is connected to an ECU, This page contains active *Diagnostic Trouble Codes (DTC)* only if the engine ECU generating a fault code. These are alarm conditions are detected by the engine ECU and displayed by the DSE controller.

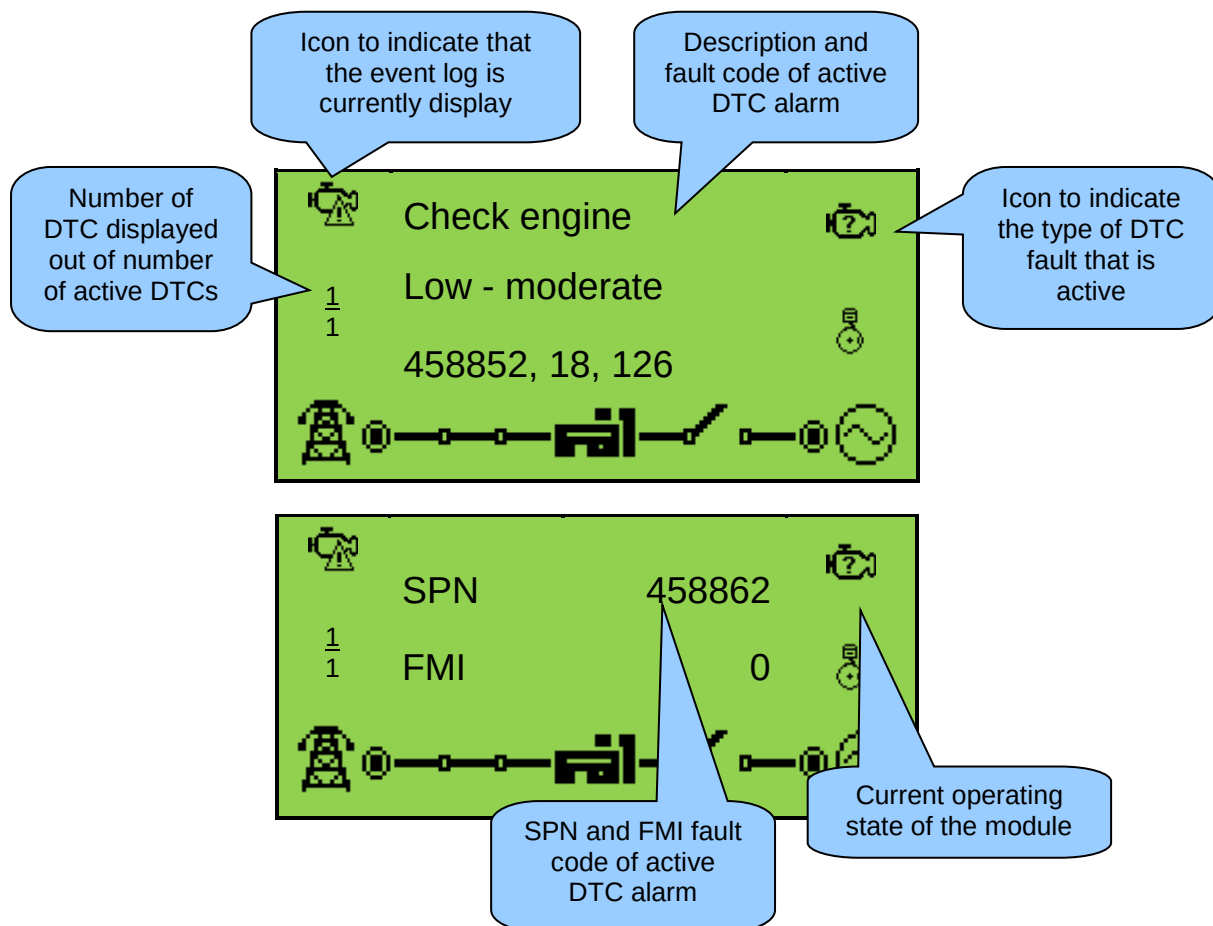
4.3.9.1 VIEWING ACTIVE ENGINE DTC

To view the engine DTC(s), press both  (up) and  (down) buttons simultaneously, the navigation menu is then displayed. Once entered, cycle to the *DTC* () section and enter.

To view the active DTC(s) alarms, repeatedly press the  (up) or  (down) buttons until the LCD screen displays the alarm.

Continuing to press the  (up) or  (down) buttons will cycle through the alarms.

To exit the active DTC(s) alarm section, press the  (up) and  (down) buttons simultaneously to enter the navigation menu. Once entered, cycle to the desired instrumentation section.



A list of CAN fault icons is overleaf...



 **NOTE:** For details on these code meanings, refer to the ECU instructions provided by the engine manufacturer, or contact the engine manufacturer for further assistance.

 **NOTE:** For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

Icon	Fault	DTC Description
	Check Engine Fault	The engine ECU has detected a fault not recognised by the DSE module, contact engine manufacturer for support.
	Low Oil Pressure	The engine ECU has detected that the engine oil pressure has fallen below its configured low oil pressure alarm level.
	Under Speed	The engine ECU has detected that the engine speed has fallen below its configured under speed alarm level.
	Over Speed	The engine ECU has detected that the engine speed has risen above its configured over speed alarm level.
	Charge Failure	The engine ECU has detected that the engine's charge alternator output has fallen below its configured alarm level.
	Low Fuel Level	The engine ECU has detected that the engine's fuel level has fallen below its configured low fuel level alarm.
	Battery Under/Over Voltage	The engine ECU has detected that the engine's DC supply has fallen below or risen above its configured alarm level.



4.3.10 EVENT LOG

This module's event log contains a list of the last 50 record electrical trips, shutdowns, mains fails, mains returns and power up events and the engine hours at which they occurred.

Once the log is full, any subsequent electrical trip or shutdown alarms overwrites the oldest entry in the log. Hence, the log always contains the most recent shutdown alarms. The module logs the alarm, along with the engine running hours.

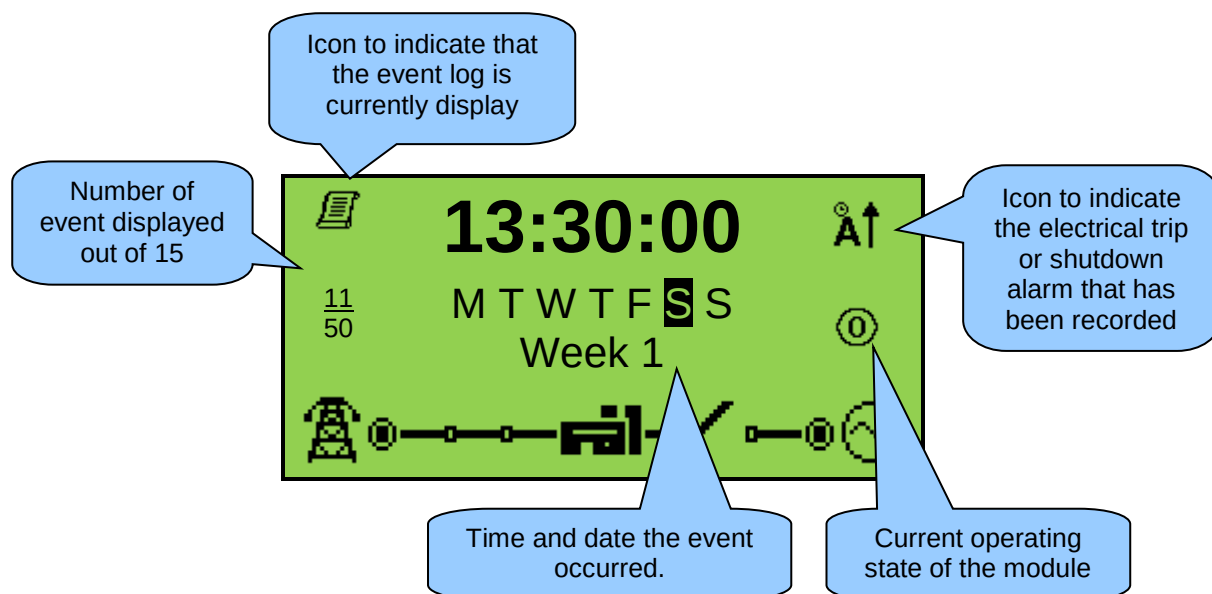
4.3.10.1 VIEWING THE EVENT LOG

To view the event log, press both  (up) and  (down) buttons simultaneously, the navigation menu is then displayed. Once entered, cycle to the *Event Log* () section and enter.

To view the event log, repeatedly press the  (up) or  (down) buttons until the LCD screen displays the desired event.

Continuing to press down the  (up) or  (down) buttons will cycle through the past alarms after which the display shows the most recent alarm and the cycle begins again.

To exit the event log, press the  (up) and  (down) buttons simultaneously to enter the navigation menu. Once entered, cycle to the desired instrumentation section.



The events shown in the below table are recorded into the module's event log in addition to all electrical trip and shutdown alarms.

Icon	Event	Description
	Mains Failure	The mains supply was detected as failed as it had risen above or fallen below the pre-set alarm setting.
	Mains Return	The mains supply was detected as healthy as it was not longer in a fault condition
	Module Power Up	The module was powered up



4.3.11 ENGINE TIER 4 INFORMATION

 **NOTE:** For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Software Manual*.

 **NOTE:** For details on these icon meanings, refer to the ECU instructions provided by the engine manufacturer, or contact the engine manufacturer for further assistance.

 **NOTE:** For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

If the DSE module is connected to an ECU, This page contains active *Engine Tier 4 Lamps* only if the engine ECU is generating a fault code. These are alarm conditions are detected by the engine ECU and displayed by the DSE controller.

To view the *Engine Tier 4 Lamps* or *DPF Inhibit Control* page, press the  (up) or  (down) buttons until the LCD screen displays the desired event.

Continuing to press down the  (up) or  (down) buttons will cycle through the past alarms after which the display shows the most recent alarm and the cycle begins again.

To view the *Engine Tier 4 Lamps* or *DPF Inhibit Control* page, press both  (up) and  (down) buttons simultaneously, the navigation menu is then displayed. Once entered, cycle to the *Engine Tier 4* () section and enter.

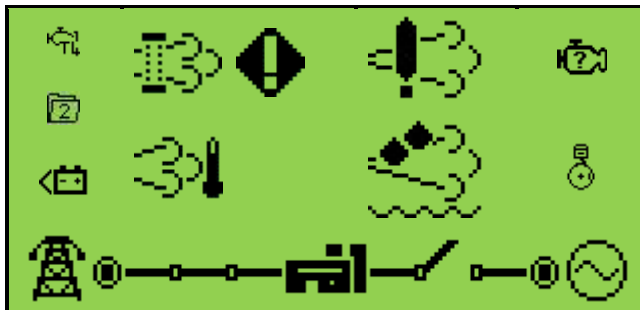
To view the *Engine Tier 4 Lamps* or *DPF Inhibit Control* pages, press the  (up) or  (down) buttons until the LCD screen displays the desired page.

To exit the *Engine Tier 4* section, press the  (up) and  (down) buttons simultaneously to enter the navigation menu. Once entered, cycle to the desired instrumentation section.



4.3.11.1 ENGINE TIER 4 LAMPS

NOTE: Depending upon the module's configuration, the home screen may be set to display engine tier 4 information. For further details of module configuration, refer to DSE Publication: 057-258 *DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

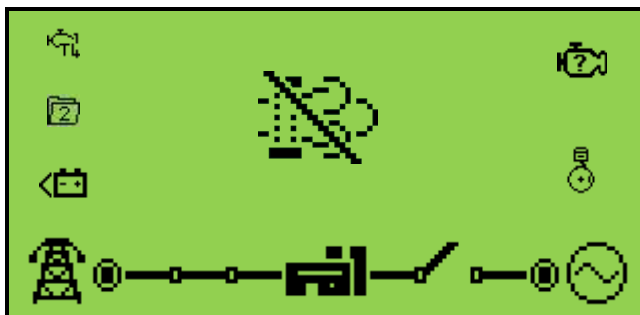


Icon	Fault	Description
	ECU Amber Alarm	The module received an Amber fault condition from the engine ECU.
	ECU Red Alarm	The module received a Red fault condition from the engine ECU.
	DPF Stop	The module received a fault indication from the engine ECU informing that the <i>Diesel Particulate Filter</i> has been stopped.
	DPF Warning	The module received a fault condition from the engine ECU informing that the <i>Diesel Particulate Filter</i> has a fault condition.
	HEST Active	The module received a fault indication from the engine ECU informing that the <i>High Exhaust System Temperature</i> is active.
	DEF Low Level	The module received a fault condition from the engine ECU informing that the <i>Diesel Exhaust Fluid Low Level</i> is active.
	SCR Inducement	The module received a fault indication from the engine ECU informing that the <i>Selective Catalytic Reduction Inducement</i> is active.



4.3.11.2 DPF INHIBIT CONTROL

To inhibit or enable the DPF Control, press the **Auto Mode**  (✓) button.



Icon	Fault	Description
	DPF Active	The module received a fault indication from the engine ECU informing that the <i>Diesel Particulate Filter</i> is active.
	DPF Inhibited	The module received a fault indication from the engine ECU informing that the <i>Diesel Particulate Filter</i> has been inhibited.



5 OPERATION

NOTE: The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

5.1 QUICKSTART GUIDE

This section provides a quick start guide to the module's operation.

5.1.1 STARTING THE ENGINE

NOTE: For further details, see the section entitled *Operation* elsewhere in this document.



5.1.2 STOPPING THE ENGINE

 **NOTE:** For further details, see the section entitled *Operation* elsewhere in this document.



5.2 STOP/RESET MODE

 **NOTE:** If a digital input configured to *Panel Lock* is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by *Panel Lock*.

 **NOTE:** For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

Stop/Reset Mode is activated by pressing the **Stop/Reset Mode**  button.

The **Stop/Reset**  icon is displayed to indicate **Stop/Reset Mode** operations.

In **Stop/Reset Mode** , the module removes the generator from load (if necessary) before stopping the generator.

If the generator does not stop when requested, the **Fail To Stop**  alarm is activated (subject to the setting of the *Fail to Stop* timer). To detect the engine at rest the following must occur:

- Engine speed is zero as detected by the CAN ECU
- Generator AC Voltage and Frequency must be zero.
- Engine Charge Alternator Voltage must be zero.
- Oil pressure sensor must indicate low oil pressure

When the engine has stopped and the module is in the **Stop/Reset Mode** , it is possible to send configuration files to the module from DSE Configuration Suite PC software and to enter the Front Panel Editor to change parameters.

Any latched alarms that have been cleared are reset when **Stop/Reset Mode**  is entered.

The engine is not started when in **Stop/Reset Mode** . If start signals are given, the input is ignored until **Auto Mode**  is entered.

When the unit is configured for 'Power Save Mode' and has been left in **Stop/Reset Mode**  with no presses of the fascia buttons, the module enters Power Save Mode. To 'wake' the module, press any fascia control buttons or activate Digital Input A. The same is true for Deep Sleep Mode.

Power Save & Deep Sleep Mode in the DSE Configuration Suite Software

Power Save Mode Enable



Deep Sleep Mode Enable



5.3 AUTOMATIC MODE

 **NOTE:** If a digital input configured to external *Panel Lock* is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by *Panel Lock*.

Auto Mode is activated by pressing the **Auto Mode**  button.

The **Auto Mode**  icon is displayed to indicate **Auto Mode** operations if no alarms are present.

Auto Mode  allows the generator to operate fully automatically, starting and stopping as required with no user intervention.

5.3.1 WAITING IN AUTO MODE

If a starting request is made, the starting sequence begins.
Starting requests can be from the following sources:

- Failure of mains supply (DSE4520 MKII only)
- Activation of the inbuilt exercise scheduler.
- Activation of an auxiliary input that has been configured to *Remote Start On Load* or *Remote Start Off Load*.
- Activation of an auxiliary input that has been configured to *Auxiliary Mains Fail* (DSE4520 MKII Only).



5.3.2 STARTING SEQUENCE



NOTE: If the unit has been configured for CAN, compatible ECU's receive the start command via CAN and transmit the engine speed to the DSE controller.



NOTE: For further details of module configuration, refer to DSE Publication: *057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

To allow for 'false' start requests, the *Start Delay* timer begins.

Should all start requests be removed during the *Start Delay* timer, the unit returns to a stand-by state.

If a start request is still present at the end of the *Start Delay* timer, the fuel relay is energised and the engine is cranked.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the *Crank Rest* duration after which the next start attempt is made. Should this sequence continue beyond the *Set Number Of Attempts*, the start sequence is terminated and the display shows **Fail to Start !L**.

The starter motor is disengaged when the engine fires. Speed detection is factory configured to be derived from the AC alternator output frequency, but can additionally be measured from a Magnetic Pickup mounted on the flywheel or from the CAN link to the engine ECU depending on module.

Additionally, rising oil pressure can be used to disconnect the starter motor (but cannot detect underspeed or overspeed).

After the starter motor has disengaged, the *Safety On Delay* timer activates, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.



5.3.3 ENGINE RUNNING



NOTE: The load transfer signal remains inactive until the generator is available. This prevents excessive wear on the engine and alternator.

The generator is placed on load if configured to do so.

If all start requests are removed, the *Stopping Sequence* begins.

5.3.4 STOPPING SEQUENCE

The *Return Delay* timer operates to ensure that the starting request has been permanently removed and isn't just a short term removal. Should another start request be made during the cooling down period, the set returns on load.

If there are no starting requests at the end of the *Return Delay* timer, the load is transferred from the generator to the mains supply and the *Cooling Down* timer is initiated.

The *Cooling Down* timer allows the set to run off load and cool sufficiently before being stopped. This is particularly important where turbo chargers are fitted to the engine.

After the *Cooling Down* timer has expired, the set is stopped.



5.4 MANUAL/START MODE

 **NOTE:** If a digital input configured to Panel Lock is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

To begin the starting sequence, press the **Manual/Start Mode**  button. If 'protected start' is disabled, the start sequence begins immediately.

 **NOTE:** For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual.**

If Protected Start is enabled, the **Waiting in Manual Mode**  icon is displayed and the LED above the **Manual/Start Mode**  button flashes to indicate **Waiting in Manual Mode**.

The **Manual/Start Mode**  button must be pressed once more to begin the start sequence.

Protected Start Mode



Protected Start Mode setting in the DSE Configuration Suite Software

5.4.1 STARTING SEQUENCE

 **NOTE:** There is no *Start Delay* in this mode of operation.

 **NOTE:** If the unit has been configured for CAN, compatible ECU's receives the start command via CAN.

 **NOTE:** For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual.**

The fuel relay is energised and the engine is cranked.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the *Crank Rest Timer* duration after which the next start attempt is made. Should this sequence continue beyond the set *Number Of Attempts*, the start sequence is terminated and the display shows **Fail to Start** .

The starter motor is disengaged when the engine fires. Speed detection is factory configured to be derived from the AC alternator output frequency, but can additionally be measured from a Magnetic Pickup mounted on the flywheel or from the CANbus link to the engine ECU depending on module configuration.

Additionally, rising oil pressure can be used to disconnect the starter motor (but cannot detect underspeed or overspeed).

After the starter motor has disengaged, the *Safety On Delay* timer activates, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.



5.4.2 ENGINE RUNNING



NOTE: The load transfer signal remains inactive until the generator is available. This prevents excessive wear on the engine and alternator.

In **Manual/Start Mode** , the load is not transferred to the generator unless a 'loading request' is made.

A loading request can come from a number of sources.

- Failure of mains supply (DSE4520 MKII only)
- Activation of an auxiliary input that has been configured to *Remote Start On Load or Transfer to Generator, Open Mains*
- Activation of an auxiliary input that has been configured to *Auxiliary Mains Fail* (DSE4520 MKII Only).
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

Once the generator has been placed on load, it is not automatically removed. To manually remove the load either:

- Activation of an auxiliary input that has been configured to *Transfer to Mains, Open Generator*
- Press the **Auto Mode**  button to return to automatic mode. The set observes all **Auto Mode**  start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the **Stop/Reset Mode**  button to remove load and stop the generator.
- Activation of an auxiliary input that has been configured to *Generator Load Inhibit*.

5.4.3 STOPPING SEQUENCE

In **Manual/Start Mode** , the set continues to run until either:

- The **Stop/Reset Mode**  button is pressed – The delayed load outputs are de-activated immediately and the set immediately stops.
- The **Auto Mode**  button is pressed. The set observes all **Auto Mode**  start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.



5.5 MAINTENANCE ALARMS

Depending upon module configuration one or more levels of engine maintenance alarm may occur based upon a configurable schedule.

Example 1

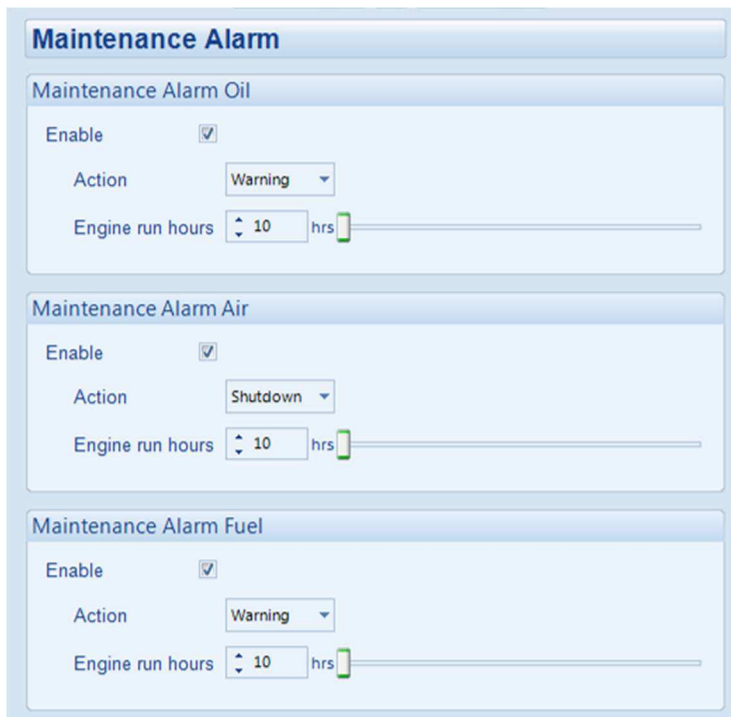
Screen capture from DSE Configuration Suite Software showing the configuration of the Maintenance Alarm for Oil, Air and Fuel.

When activated, the maintenance alarm can be either a **warning** (set continues to run) or **shutdown** (running the set is not possible).

Resetting the maintenance alarm is normally actioned by the site service engineer after performing the required maintenance.

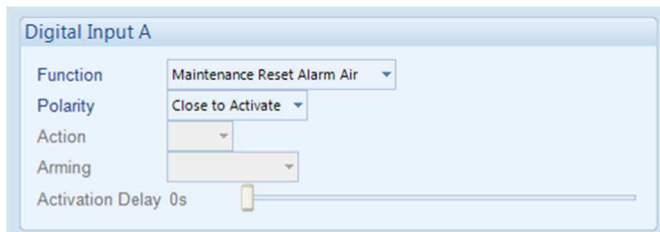
The method of reset is either by:

- Activating an input that has been configured to Maintenance Reset Alarm x, where x is the type of maintenance alarm (Air, Fuel or Oil).
- Pressing the maintenance reset button in the DSE Configuration Suite, Maintenance section.
- Pressing and holding the **Stop/Reset Mode**  button for 10 seconds on the desired Maintenance Alarm status page. This can be protected by a PIN number.



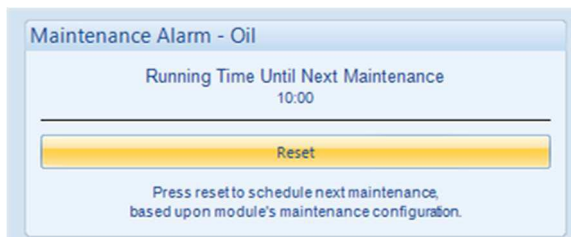
Example 2

Screen capture from DSE Configuration Suite Software showing the configuration of a digital input for Maintenance Reset Alarm Air.



Example 3

Screen capture from DSE Configuration Suite Software showing the Maintenance Alarm Reset 'button' in the DSE Configuration Suite SCADA | MAINTENANCE section.




5.6 SCHEDULER

The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set. Up to 8 scheduled start/stop sequences can be configured to repeat on a 7-day or 28-day cycle.

Scheduled runs may be on load or off load depending upon module configuration.

Example

Screen capture from DSE Configuration Suite Software showing the configuration of the Exercise Scheduler.

In this example the set will start at 09:00 on Monday and run for 5 hours, then start at 13:30 on Tuesday and run for 30 minutes.

Week	Day	Start Time	Duration	
	Monday	09:00	05:00	Clear
	Tuesday	13:30	00:30	Clear
	Monday	00:00	00:00	Clear
	Monday	00:00	00:00	Clear
	Monday	00:00	00:00	Clear
	Monday	00:00	00:00	Clear
	Monday	00:00	00:00	Clear
	Monday	00:00	00:00	Clear

5.6.1 STOP MODE

- Scheduled runs do not occur when the module is in **Stop/Reset Mode** .

5.6.2 MANUAL MODE

- Scheduled runs do not occur when the module is in **Manual/Start Mode**  waiting for a start request.
- Activation of a Scheduled Run 'On Load' when the module is operating Off Load in **Manual/Start Mode**  the set to run On Load.

5.6.3 AUTO MODE

- Scheduled runs operate only if the module is in **Auto Mode**  with no *Shutdown* or *Electrical Trip* alarm active.
- If the module is in **Stop/Reset Mode**  or **Manual/Start Mode**  when a scheduled run begins, the engine is not started. However, if the module is moved into **Auto Mode**  during a scheduled run, the engine is called to start.
- Depending upon configuration by the system designer, an external input can be used to inhibit a scheduled run.
- If the engine is running *Off Load* in **Auto Mode**  and a scheduled run configured to 'On Load' begins, the set is placed *On Load* for the duration of the Schedule.



5.8 ALTERNATIVE CONFIGURATIONS

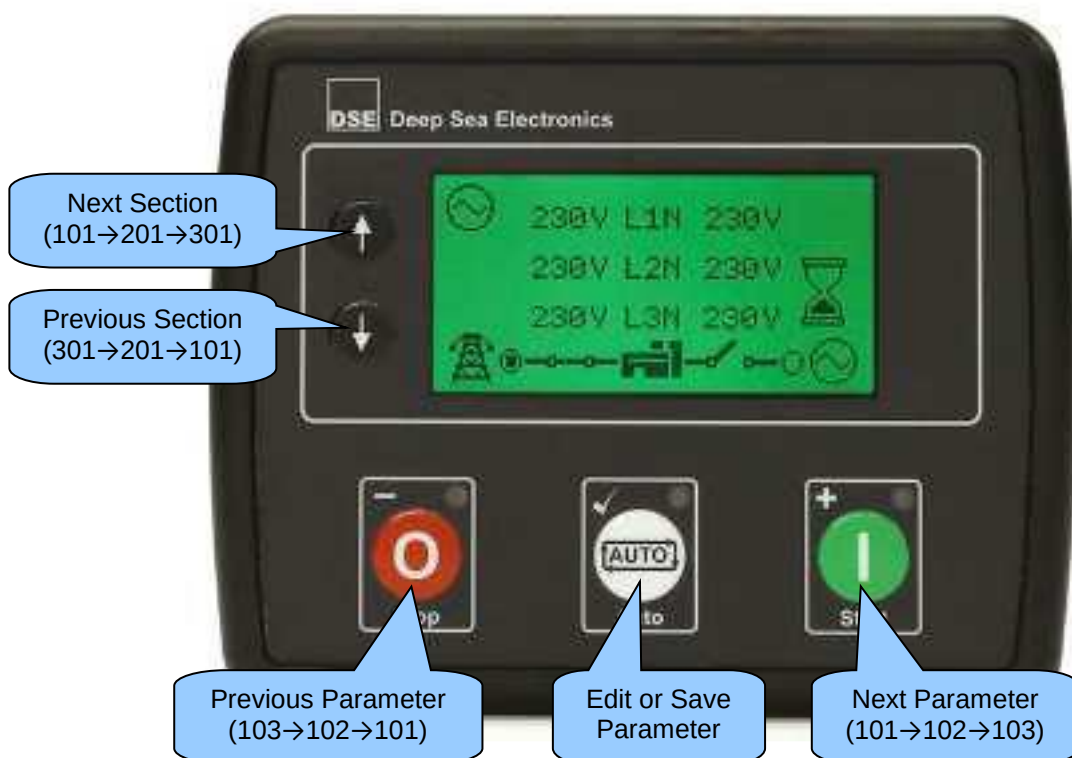
Depending upon the configuration of the system by the generator supplier, the system may have selectable configurations (for example to select between 50 Hz and 60 Hz). If this has been enabled the generator supplier will advise how this selection can be made (usually by operating an external selector switch or by selecting the required configuration file in the module's front panel configuration editor).



6 FRONT PANEL CONFIGURATION

This configuration mode allows the operator to configure the majority of the module through its display without the use of the DSE Configuration Suite PC Software.

Use the module's facia buttons to traverse the menu and make value changes to the parameters:



6.1 ACCESSING THE MAIN CONFIGURATION EDITOR

 **NOTE:** More comprehensive module configuration is possible via PC configuration software. For further details of module configuration, refer to DSE Publication: 057- 258 *DSE4510 MKII & DSE4520 MKII Configuration Suite PC Software Manual*.

- Ensure the engine is at rest and the module by pressing the **Stop/Reset Mode**  button.
- Press the **Stop/Reset Mode**  (-) and **Auto Mode**  (✓) buttons together to enter the main configuration editor.

6.2 ENTERING PIN

 **NOTE:** The PIN is not set by DSE when the module leaves the factory. If the module has a PIN code set, the generator supplier has entered this. Contact the generator supplier if the code is required. If the code has been 'lost' or 'forgotten', the module must be returned to the DSE factory to have the PIN removed. A charge is made for this procedure. This procedure cannot be performed away from the DSE factory.

 **NOTE:** The PIN is automatically reset when the editor is exited (manually or automatically) to ensure security.

- If a module security PIN has been set, the PIN request is then shown.
- Press the **Auto Mode**  (✓), the first '#' changes to '0'. Press the **Up**  or **Down**  buttons to adjust it to the correct value.
- Press the **Manual/Start Mode**  (!) (+) buttons to move to the next digit. The digit previously entered now shows as '#' for security.
- Repeat this process for the other digits of the PIN number. Press the **Stop/Reset Mode**  (-) button to move back to adjust one of the previous digits.
- When the **Auto Mode**  (✓) button is pressed after editing the final PIN digit, the PIN is checked for validity. If the number is not correct, the PIN must be re-entered.
- If the PIN has been successfully entered (or the module PIN has not been enabled), the editor is displayed.



6.3 EDITING A PARAMETER

 **NOTE:** Pressing and holding the **Stop/Reset Mode**  (-) or **Manual/Start Mode**  (+) buttons enables an auto-repeat functionality.

- Once in the selected editor, press the **Up**  and **Down**  navigation buttons to cycle through it in increments of 100.
- Press the **Stop/Reset Mode**  (-) or **Manual/Start Mode**  (+) buttons to cycle through the editor in increments of 1.
- When viewing the parameter to be edited, press the **Auto Mode**  (✓) button, the value begins to flash.
- Press the **Stop/Reset Mode**  (-) or **Manual/Start Mode**  (+) buttons to adjust the value to the required setting.
- Press the **Auto Mode**  (✓) button the save the current value, the value ceases flashing.

6.4 EXITING THE MAIN CONFIGURATION EDITOR

 **NOTE:** The editor automatically exits after 5 minutes of inactivity to ensure security.

- Press and hold the **Stop/Reset Mode**  (-) button to exit the editor without saving changes.
- Press and hold the **Auto Mode**  (✓) button to exit the editor and save the changes.



6.5 ADJUSTABLE PARAMETERS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

6.5.1 MODULE SETTINGS

Configuration Parameters – Module (Page 1)		
101	Contrast	0 (%)
102	Fast Loading Enabled	On (1), Off (0)
103	All Warnings Latched	On (1), Off (0)
104	Lamp Test At Startup	On (1), Off (0)
105	Power Save Mode Enable	On (1), Off (0)
106	Deep Sleep Mode Enable	On (1), Off (0)
107	Protected Start Enable	On (1), Off (0)
108	Event Log Display Format	On (1), Off (0)
109	Power Up Mode	0 (Power Up Mode)
110	DTC String Enable	On (1), Off (0)
111	RESERVED	
112	Pin Protected Maintenance Reset	On (1), Off (0)
113	Stop Button Cooldown	On (1), Off (0)
114	Use Module Oil Pressure	On (1), Off (0)
115	Use Module Coolant Temp	On (1), Off (0)
116	Use Module Engine Hours	On (1), Off (0)
117	Use Module RPM	On (1), Off (0)
118	Use Module Charge Alt	On (1), Off (0)
119	Disable CAN Speed Control	On (1), Off (0)
120	CT Position	Gen (0), Load(1)
121	Generator Voltage Display	On (1), Off (0)
122	Mains Voltage Display	On (1), Off (0)
123	Generator Frequency Display	On (1), Off (0)
124	Mains Frequency Display	On (1), Off (0)
125	Current Display	On (1), Off (0)
126	kW Display	On (1), Off (0)
127	kVAr Display	On (1), Off (0)
128	kVA Display	On (1), Off (0)
129	pf Display	On (1), Off (0)
130	kWh Display	On (1), Off (0)
131	kVArh Display	On (1), Off (0)
132	kVAh Display	On (1), Off (0)

6.5.2 CAN SETTINGS

Configuration Parameters – CAN Application (Page 2)		
201	CAN Alternative Engine Speed	On (1), Off (0)
202	CAN ECU Data Fail Enable	On (1), Off (0)
203	CAN ECU Data Fail Action	0 (Action)
204	CAN ECU Data Fail Delay	0 s



6.5.3 DIGITAL INPUT SETTINGS

Configuration Parameters – Digital Inputs (Page 3)		
301	Digital Input A Source	0 (Input Source)
302	Digital Input A Polarity	0 (Polarity)
303	Digital Input A Action (If Source = User Config)	0 (Action)
304	Digital Input A Arming (If Source = User Config)	0 (Arming)
305	Digital Input A Activation Delay (If Source = User Config)	0 s
306	Digital Input B Source	0 (Input Source)
307	Digital Input B Polarity	0 (Polarity)
308	Digital Input B Action (If Source = User Config)	0 (Action)
309	Digital Input B Arming (If Source = User Config)	0 (Arming)
310	Digital Input B Activation Delay (If Source = User Config)	0 s
311	Digital Input C Source	0 (Input Source)
312	Digital Input C Polarity	0 (Polarity)
313	Digital Input C Action (If Source = User Config)	0 (Action)
314	Digital Input C Arming (If Source = User Config)	0 (Arming)
315	Digital Input C Activation Delay (If Source = User Config)	0 s
316	Digital Input D Source	0 (Input Source)
317	Digital Input D Polarity	0 (Polarity)
318	Digital Input D Action (If Source = User Config)	0 (Action)
319	Digital Input D Arming (If Source = User Config)	0 (Arming)
320	Digital Input D Activation Delay (If Source = User Config)	0 s
321-330	RESERVED	
331	Analogue Input A (Set As Digital) Source	0 (Input Source)
332	Analogue Input A (Set As Digital) Polarity	0 (Polarity)
333	Analogue Input A (Set As Digital) Action (If Source = User Config)	0 (Action)
334	Analogue Input A (Set As Digital) Arming (If Source = User Config)	0 (Arming)
335	Analogue Input A (Set As Digital) Activation Delay (If Source = User Config)	0 s
336	Analogue Input B (Set As Digital) Source	0 (Input Source)
337	Analogue Input B (Set As Digital) Polarity	0 (Polarity)
338	Analogue Input B (Set As Digital) Action (If Source = User Config)	0 (Action)
339	Analogue Input B (Set As Digital) Arming (If Source = User Config)	0 (Arming)
340	Analogue Input B (Set As Digital) Activation Delay (If Source = User Config)	0 s
341	Analogue Input C (Set As Digital) Source	0 (Input Source)
342	Analogue Input C (Set As Digital) Polarity	0 (Polarity)
343	Analogue Input C (Set As Digital) Action (If Source = User Config)	0 (Action)
344	Analogue Input C (Set As Digital) Arming (If Source = User Config)	0 (Arming)
345	Analogue Input C (Set As Digital) Activation Delay (If Source = User Config)	0 s



6.5.4 DIGITAL OUTPUT SETTINGS

Configuration Parameters – Outputs (Page 4)		
401	Digital Output A Source	0 (Output Source)
402	Digital Output A Polarity	0 (Output Polarity)
403	Digital Output B Source	0 (Output Source)
404	Digital Output B Polarity	0 (Output Polarity)
405	Digital Output C Source	0 (Output Source)
406	Digital Output C Polarity	0 (Output Polarity)
407	Digital Output D Source	0 (Output Source)
408	Digital Output D Polarity	0 (Output Polarity)
409	Digital Output E Source	0 (Output Source)
410	Digital Output E Polarity	0 (Output Polarity)
411	Digital Output F Source	0 (Output Source)
412	Digital Output F Polarity	0 (Output Polarity)

6.5.5 TIMER SETTINGS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Timers (Page 5)		
501	Mains Transient Delay	
502	Start Delay	
503	Preheat Timer	
504	Crank Time	
505	Crank Rest Time	
506	Smoke Limiting	
507	Smoke Limiting Off	
508	DPF Ramp	
509	Safety On Delay	
510	Warm Up Time	
511	Return Delay	
512	Cooling Time	
513	ETS Solenoid Hold	
514	Failed To Stop Delay	
515	Generator Transient Delay	
516	Transfer Time	
517	Breaker Trip Pulse	
518	Breaker Close Pulse	
519	Delayed Load Output 1	
520	Delayed Load Output 2	
521	Delayed Load Output 3	
522	Delayed Load Output 4	
523	Power Save Mode Delay	
524	Deep Sleep Mode Delay	
525	Page Timer	
526	Cooling Time at Idle	



6.5.6 GENERATOR SETTINGS

Configuration Parameters – Generator (Page 6)		
601	Alternator Fitted	On (1), Off (0)
602	Alternator Poles	0
603	Under Voltage Shutdown Enable	On (1), Off (0)
604	Under Voltage Trip Shutdown	0 V
605	Under Voltage Warning Enable	On (1), Off (0)
606	Under Voltage Warning Trip	0 V
607	RESERVED	
608	Loading Voltage	0 V
609	Over Voltage Warning Enable	On (1), Off (0)
610	Over Voltage Warning Return	0 V
611	Over Voltage Warning Trip	0 V
612	Over Voltage Shutdown Trip	0 V
613	Under Frequency Shutdown Enable	On (1), Off (0)
614	Under Frequency Shutdown Trip	0.0 Hz
615	Under Frequency Warning Enable	On (1), Off (0)
616	Under Frequency Warning Trip	0.0 Hz
617	RESERVED	
618	Loading Frequency	0.0 Hz
619	Nominal Frequency	0.0 Hz
620	Over Frequency Warning Enable	On (1), Off (0)
621	Over Frequency Warning Return	0.0 Hz
622	Over Frequency Warning Trip	0.0 Hz
623	Over Frequency Shutdown Enable	On (1), Off (0)
624	Over Frequency Shutdown Trip	0.0 Hz
625	AC System	0 (AC System)
626	CT Primary	0 A
627	CT Secondary	1 A, 5 A
628	Full Load Rating	0 A
629	Immediate Over Current Enable	On (1), Off (0)
630	Delayed Over Current Alarm Enable	On (1), Off (0)
631	Delayed Over Current Alarm Action	0 (Action)
632	Over Current Delay Time	0 s
633	Over Current Trip	0 %
634	kW Rating	0 kW
635	Over kW Protection Enable	On (1), Off (0)
636	Over kW Protection Action	0 (Action)
637	Over kW Protection Trip	0 %
638	Over kW Protection Trip Delay	0 s
639	Enable CT Support	On (1), Off (0)



6.5.7 MAINS SETTINGS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Mains (Page 7)		
701	AC System	0 (AC System)
702	Mains Failure Detection	On (1), Off (0)
703	Immediate Mains Dropout	On (1), Off (0)
704	Under Voltage Enable	On (1), Off (0)
705	Under Voltage Level	0 V
706	Under Voltage Return	0 V
707	Over Voltage Enable	On (1), Off (0)
708	Over Voltage Return	0 V
709	Over Voltage Level Trip	0 V
710	Under Frequency Enable	On (1), Off (0)
711	Under Frequency Trip	0.0 Hz
712	Under Frequency Return	0.0 Hz
713	Over Frequency Enable	On (1), Off (0)
714	Over Frequency Return	0 Hz
715	Over Frequency Trip	0.0 Hz



6.5.8 ENGINE SETTINGS

Configuration Parameters – Engine (Page 8)		
801	Start Attempts	0
802	Over Speed Overshoot	0 %
803	Over Speed Delay	0 s
804	Gas Choke Timer (Gas Engine Only)	0 s
805	Gas On Delay (Gas Engine Only)	0 s
806	Gas Ignition Off Delay (Gas Engine Only)	0 s
807	Crank Disconnect On Oil Pressure Enable	On (1), Off (0)
808	Check Oil Pressure Prior To Starting	On (1), Off (0)
809	Crank Disconnect On Oil	0.00 Bar
810	Crank Disconnect On Frequency	0.0 Hz
811	Crank Disconnect On Engine Speed	0 RPM
812	Under Speed Enable	On (1), Off (0)
813	Under Speed Trip	0 RPM
814	Over Speed Trip	0 RPM
815	Low Battery Voltage Enable	On (1), Off (0)
816	Low Battery Voltage Trip	0.0 V
817	Low Battery Voltage Return	0.0 V
818	Low Battery Voltage Delay	0:00:00
819	High Battery Voltage Enable	On (1), Off (0)
820	High Battery Voltage Return	0.0 V
821	High Battery Voltage Trip	0.0 V
822	High Battery Voltage Warning Delay	0 s
823	Charge Alt Shutdown Enable	On (1), Off (0)
824	Charge Alt Shutdown Trip	0.0 V
825	Charge Alt Shutdown Delay	0 s
826	Charge Alt Warning Enable	On (1), Off (0)
827	Charge Alt Warning Trip	0.0 V
828	Charge Alt Warning Delay	0 s
829	Low Battery Start Arming	On (1), Off (0)
830	Low Battery Start Threshold	0.0 V
831	Low Battery Start Delay	0 s
832	Low Battery Start Run Time	0 s
833	RESERVED	
834	RESERVED	
835	J1939-75 Instruments Enable	On (1), Off (0)
836	J1939-75 Alarms Enable	On (1), Off (0)
837	CAN TX Messages Enable	On (1), Off (0)
838	CAN TX Instruments Enable	On (1), Off (0)
839	RESERVED	
840	Tier 4 Home Screen Enable	On (1), Off (0)
841	Start Pause Time	0 s



6.5.9 ANALOGUE INPUT SETTINGS

Configuration Parameters – Analogue Inputs (Page 9)		
901	Analogue Input A Sensor Type	0 (Sensor Type)
902	Analogue Input A Sensor Selection	0 (Pressure Sensor List)
903	Low Oil Pressure Enable	On (1), Off (0)
904	Low Oil Pressure Trip	0 Bar
905	Oil Pressure Sensor Open Circuit	On (1), Off (0)
906	Analogue Input B Sensor Type	0 (Sensor Type)
907	Analogue Input B Sensor Selection	0 (Temperature Sensor List)
908	High Engine Temperature Trip	0.00 °C
909	Temperature Sensor Open Circuit	On (1), Off (0)
910	Analogue Input C Sensor Usage	Flexible Sensor (1), Fuel Level Sensor (0)
911	Analogue Input C Sensor Type	0 (Sensor Type)
912	Analogue Input C Sensor Selection	0 (Pressure / Temperature / Percentage Sensor List)
913	Flexible Sensor C Arming	0 (Arming)
914	Flexible Sensor C Low Alarm Action	0 (Action)
915	Flexible Sensor C Low Alarm Trip	0 % / Bar / °C
916	RESERVED	
917	Flexible Sensor C Low Pre-Alarm Enable	On (1), Off (0)
918	Flexible Sensor C Low Pre-Alarm Trip	0 % / Bar / °C
919	Flexible Sensor C Low Pre-Alarm Return	0 % / Bar / °C
920	RESERVED	
921	Flexible Sensor C High Pre-Alarm Enable	On (1), Off (0)
922	Flexible Sensor C High Pre-Alarm Return	0 % / Bar / °C
923	Flexible Sensor C High Pre-Alarm Trip	0 % / Bar / °C
924-925	RESERVED	
926	Flexible Sensor C High Alarm Action	0 (Action)
927	Flexible Sensor C High Alarm Trip	0 % / Bar / °C
928-929	RESERVED	
930	Fuel Sensor C Low Shutdown Enable	On (1), Off (0)
931	Fuel Sensor C Low Shutdown Trip	0 %
932	Fuel Sensor C Low Shutdown Delay	0 s
933	Fuel Sensor C Low Pre-Alarm Enable	On (1), Off (0)
934	Fuel Sensor C Low Pre-Alarm Trip	0 %
935	Fuel Sensor C Low Pre-Alarm Return	0 %
936	Fuel Sensor C Low Pre-Alarm Delay	0 s
937	Fuel Sensor C High Pre-Alarm Enable	On (1), Off (0)
938	Fuel Sensor C High Pre-Alarm Return	0 %
939	Fuel Sensor C High Pre-Alarm Trip	0 %
940	Fuel Sensor C High Pre Alarm Delay	0 s
941	RESERVED	
942	Fuel Sensor C High Alarm Action	0 (Action)
943	Fuel Sensor C High Alarm Trip	0 %
944	Fuel Sensor C High Alarm Delay	0 s



6.5.10 SCHEDULER SETTINGS

Configuration Parameters – Scheduler (Page 10)		
1001	Enable Scheduler	On (1), Off (0)
1002	Schedule Run On or Off Load	On (1), Off (0)
1003	Scheduler Period	Weekly(0), Monthly(1)
1004	Start Time (Entry 1)	0:00:00
1005	Day (Entry 1)	0 (1=Monday)
1006	Week (Entry 1)	1, 2, 3 or 4
1007	Duration (Entry 1)	0 s
1008	Start Time (Entry 2)	0:00:00
1009	Day (Entry 2)	0 (1=Monday)
1010	Week (Entry 2)	1, 2, 3 or 4
1011	Duration (Entry 2)	0 s
1012	Start Time (Entry 3)	0:00:00
1013	Day (Entry 3)	0 (1=Monday)
1014	Week (Entry 3)	1, 2, 3 or 4
1015	Duration (Entry 3)	0 s
1016	Start Time (Entry 4)	0:00:00
1017	Day (Entry 4)	0 (1=Monday)
1018	Week (Entry 4)	1, 2, 3 or 4
1019	Duration (Entry 4)	0 s
1020	Start Time (Entry 5)	0:00:00
1021	Day (Entry 5)	0 (1=Monday)
1022	Week (Entry 5)	1, 2, 3 or 4
1023	Duration (Entry 5)	0 s
1024	Start Time (Entry 6)	0:00:00
1025	Day (Entry 6)	0 (1=Monday)
1026	Week (Entry 6)	1, 2, 3 or 4
1027	Duration (Entry 6)	0 s
1028	Start Time (Entry 7)	0:00:00
1029	Day (Entry 7)	0 (1=Monday)
1030	Week (Entry 7)	1, 2, 3 or 4
1031	Duration (Entry 7)	0 s
1032	Start Time (Entry 8)	0:00:00
1033	Day (Entry 8)	0 (1=Monday)
1034	Week (Entry 8)	1, 2, 3 or 4
1035	Duration (Entry 8)	0 s

6.5.11 TIME SETTINGS

Configuration Parameters – Time (Page 11)		
1101	Time of Day	0:00:00
1102	RESERVED	
1103	RESERVED	
1104	Day of Month	1-31
1105	Month of Year	1-12
1106	Year	0-99



6.5.12 MAINTENANCE ALARM SETTINGS

Configuration Parameters – Maintenance Alarms (Page 12)		
1201	Oil Maintenance Alarm Enable	On (1), Off (0)
1202	Oil Maintenance Alarm Action	0 (Action)
1203	Oil Maintenance Alarm Engine Hours	0 h
1204	Air Maintenance Alarm Enable	On (1), Off (0)
1205	Air Maintenance Alarm Action	0 (Action)
1206	Air Maintenance Alarm Engine Hours	0 h
1207	Fuel Maintenance Alarm Enable	On (1), Off (0)
1208	Fuel Maintenance Alarm Action	0 (Action)
1209	Fuel Maintenance Alarm Engine Hours	0 h



6.5.13 ALTERNATIVE CONFIGURATION 1 SETTINGS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 1 (Page 20)		
2001	Default Configuration	On (1), Off (0)
2002	Enable Configuration	On (1), Off (0)
2003	CAN Alternative Engine Speed	On (1), Off (0)
2004	Under Voltage Shutdown Enable	On (1), Off (0)
2005	Under Voltage Shutdown Trip	0 V
2006	Under Voltage Warning Enable	On (1), Off (0)
2007	Under Voltage Warning Trip	0 V
2008	Loading Voltage	0 V
2009	Over Voltage Warning Enable	On (1), Off (0)
2010	Over Voltage Warning Return	0 V
2011	Over Voltage Warning Trip	0 V
2012	Over Voltage Trip	0 V
2013	Under Frequency Shutdown Enable	On (1), Off (0)
2014	Under Frequency Shutdown Trip	0.0 Hz
2015	Under Frequency Warning Enable	On (1), Off (0)
2016	Under Frequency Warning Trip	0.0 Hz
2017	Loading Frequency	0.0 Hz
2018	Nominal Frequency	0.0 Hz
2019	Over Frequency Warning Enable	On (1), Off (0)
2020	Over Frequency Warning Return	0.0 Hz
2021	Over Frequency Warning Trip	0.0 Hz
2022	Over Frequency Shutdown Enable	On (1), Off (0)
2023	Over Frequency Shutdown Trip	0.0 Hz
2024	CT Primary	0 A
2025	CT Secondary	1 A, 5 A
2026	Full Load Rating	0 A
2027	Immediate Over Current	On (1), Off (0)
2028	Delayed Over Current Alarm	On (1), Off (0)
2029	Delayed Over Current Alarm Action	0 (Action)
2030	Over Current Delay	00:00:00
2031	Over Current Trip	0 %
2032	Generator kW Rating	0 kW
2033	Overload Protection Enable	On (1), Off (0)
2034	Overload Protection Action	0 (Action)
2035	Overload Protection Trip	0 %
2036	Overload Protection Trip Delay	0 s
2037	AC System	0 (AC system)
2038	Mains Failure Detection	On (1), Off (0)
2039	Immediate Mains Dropout	On (1), Off (0)
2040	Mains Under Voltage Enable	On (1), Off (0)
2041	Mains Under Voltage Trip	0 V
2042	Mains Under Voltage Return	0 V
2043	Mains Over Voltage Enable	On (1), Off (0)
2044	Mains Over Voltage Return	0 V
2045	Mains Over Voltage Trip	0 V
2046	Mains Under Frequency Enable	On (1), Off (0)
2047	Mains Under Frequency Trip	0.0 Hz
2048	Mains Under Frequency Return	0.0 Hz

Continued overleaf...



Front Panel Configuration

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 1 (Page 20)		
2049	Mains Over Frequency Enable	On (1), Off (0)
2050	Mains Over Frequency Return	0.0 Hz
2051	Mains Over Frequency Trip	0.0 Hz
2052	Under Speed Shutdown Enable	On (1), Off (0)
2053	Under Speed Shutdown Trip	0 RPM
2054	Over Speed Shutdown Trip	0 RPM



6.5.14 ALTERNATIVE CONFIGURATION 2 SETTINGS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 2 (Page 30)		
3001	Default Configuration	On (1), Off (0)
3002	Enable Configuration	On (1), Off (0)
3003	CAN Alternative Engine Speed	On (1), Off (0)
3004	Under Voltage Shutdown Enable	On (1), Off (0)
3005	Under Voltage Shutdown Trip	0 V
3006	Under Voltage Warning Enable	On (1), Off (0)
3007	Under Voltage Warning Trip	0 V
3008	Loading Voltage	0 V
3009	Over Voltage Warning Enable	On (1), Off (0)
3010	Over Voltage Warning Return	0 V
3011	Over Voltage Warning Trip	0 V
3012	Over Voltage Trip	0 V
3013	Under Frequency Shutdown Enable	On (1), Off (0)
3014	Under Frequency Shutdown Trip	0.0 Hz
3015	Under Frequency Warning Enable	On (1), Off (0)
3016	Under Frequency Warning Trip	0.0 Hz
3017	Loading Frequency	0.0 Hz
3018	Nominal Frequency	0.0 Hz
3019	Over Frequency Warning Enable	On (1), Off (0)
3020	Over Frequency Warning Return	0.0 Hz
3021	Over Frequency Warning Trip	0.0 Hz
3022	Over Frequency Shutdown Enable	On (1), Off (0)
3023	Over Frequency Shutdown Trip	0.0 Hz
3024	CT Primary	0 A
3025	CT Secondary	1 A, 5 A
3026	Full Load Rating	0 A
3027	Immediate Over Current	On (1), Off (0)
3028	Delayed Over Current Alarm	On (1), Off (0)
3029	Delayed Over Current Alarm Action	0 (Action)
3030	Over Current Delay	00:00:00
3031	Over Current Trip	0 %
3032	Generator kW Rating	0 kW
3033	Overload Protection Enable	On (1), Off (0)
3034	Overload Protection Action	0 (Action)
3035	Overload Protection Trip	0 %
3036	Overload Protection Trip Delay	0 s
3037	AC System	0 (AC system)
3038	Mains Failure Detection	On (1), Off (0)
3039	Immediate Mains Dropout	On (1), Off (0)
3040	Mains Under Voltage Enable	On (1), Off (0)
3041	Mains Under Voltage Trip	0 V
3042	Mains Under Voltage Return	0 V
3043	Mains Over Voltage Enable	On (1), Off (0)
3044	Mains Over Voltage Return	0 V
3045	Mains Over Voltage Trip	0 V
3046	Mains Under Frequency Enable	On (1), Off (0)
3047	Mains Under Frequency Trip	0.0 Hz
3048	Mains Under Frequency Return	0.0 Hz

Continued overleaf...



Front Panel Configuration

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 2 (Page 30)		
3049	Mains Over Frequency Enable	On (1), Off (0)
3050	Mains Over Frequency Return	0.0 Hz
3051	Mains Over Frequency Trip	0.0 Hz
3052	Under Speed Shutdown Enable	On (1), Off (0)
3053	Under Speed Shutdown Trip	0 RPM
3054	Over Speed Shutdown Trip	0 RPM



6.5.15 ALTERNATIVE CONFIGURATION 3 SETTINGS

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 3 (Page 40)		
4001	Default Configuration	On (1), Off (0)
4002	Enable Configuration	On (1), Off (0)
4003	CAN Alternative Engine Speed	On (1), Off (0)
4004	Under Voltage Shutdown Enable	On (1), Off (0)
4005	Under Voltage Shutdown Trip	0 V
4006	Under Voltage Warning Enable	On (1), Off (0)
4007	Under Voltage Warning Trip	0 V
4008	Loading Voltage	0 V
4009	Over Voltage Warning Enable	On (1), Off (0)
4010	Over Voltage Warning Return	0 V
4011	Over Voltage Warning Trip	0 V
4012	Over Voltage Trip	0 V
4013	Under Frequency Shutdown Enable	On (1), Off (0)
4014	Under Frequency Shutdown Trip	0.0 Hz
4015	Under Frequency Warning Enable	On (1), Off (0)
4016	Under Frequency Warning Trip	0.0 Hz
4017	Loading Frequency	0.0 Hz
4018	Nominal Frequency	0.0 Hz
4019	Over Frequency Warning Enable	On (1), Off (0)
4020	Over Frequency Warning Return	0.0 Hz
4021	Over Frequency Warning Trip	0.0 Hz
4022	Over Frequency Shutdown Enable	On (1), Off (0)
4023	Over Frequency Shutdown Trip	0.0 Hz
4024	CT Primary	0 A
4025	CT Secondary	1 A, 5 A
4026	Full Load Rating	0 A
4027	Immediate Over Current	On (1), Off (0)
4028	Delayed Over Current Alarm	On (1), Off (0)
4029	Delayed Over Current Alarm Action	0 (Action)
4030	Over Current Delay	00:00:00
4031	Over Current Trip	0 %
4032	Generator kW Rating	0 kW
4033	Overload Protection Enable	On (1), Off (0)
4034	Overload Protection Action	0 (Action)
4035	Overload Protection Trip	0 %
4036	Overload Protection Trip Delay	0 s
4037	AC System	0 (AC system)
4038	Mains Failure Detection	On (1), Off (0)
4039	Immediate Mains Dropout	On (1), Off (0)
4040	Mains Under Voltage Enable	On (1), Off (0)
4041	Mains Under Voltage Trip	0 V
4042	Mains Under Voltage Return	0 V
4043	Mains Over Voltage Enable	On (1), Off (0)
4044	Mains Over Voltage Return	0 V
4045	Mains Over Voltage Trip	0 V
4046	Mains Under Frequency Enable	On (1), Off (0)
4047	Mains Under Frequency Trip	0.0 Hz
4048	Mains Under Frequency Return	0.0 Hz

Continued overleaf...



Front Panel Configuration

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Configuration Parameters – Alternative Configuration 3 (Page 40)		
4049	Mains Over Frequency Enable	On (1), Off (0)
4050	Mains Over Frequency Return	0.0 Hz
4051	Mains Over Frequency Trip	0.0 Hz
4052	Under Speed Shutdown Enable	On (1), Off (0)
4053	Under Speed Shutdown Trip	0 RPM
4054	Over Speed Shutdown Trip	0 RPM



6.6 SELECTABLE PARAMETERS

6.6.1 INPUT SOURCES

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Input Sources	
0	User Configured
1	Remote Start On Load
2	RESERVED
3	Auto Start Inhibit
4	Lamp Test
5	Alarm Mute
6	Alarm Reset
7	RESERVED
8	Simulate Start Button
9	Simulate Stop Button
10	RESERVED
11	Simulate Auto Button
12	RESERVED
13	Close Generator
14	Generator Load Inhibit
15	RESERVED
16	Close Mains
17	Mains Load Inhibit
18	RESERVED
19	External Panel Lock
20	Auxiliary Mains Fail
21	Oil Pressure Switch
22	Coolant Temperature Switch
23	RESERVED
24	Simulate Mains Available
25	Remote Start Off Load
26-30	RESERVED
31	Auto Restore Inhibit
32	RESERVED
33	Low Fuel Level Switch
34	Smoke Limiting
35-38	RESERVED
39	Main Configuration
40	Alternative Configuration 1
41	Alternative Configuration 2
42	Alternative Configuration 3
43	Emergency Stop
44	RESERVED
45	Maintenance Reset Oil
46	Maintenance Reset Air
47	Maintenance Reset Fuel
48	RESERVED
49	RESERVED
50	Auto Regen Disable
51	DPF Man Regen Request
52	DPF Regeneration Interlock



6.6.2 OUTPUT SOURCES

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Output Sources	
0	Not Used
1	Air Flap Relay
2	Audible Alarm
3	Battery Over Volts Warning
4	Battery Under Volts Warning
5	CAN ECU Data Fail
6	CAN ECU Error
7	CAN ECU Fail
8	CAN ECU Power
9	CAN ECU Stop
10	Charge Alternator Shutdown
11	Charge Alternator Warning
12	Close Gen Output
13	Close Gen Output Pulse
14	Close Mains Output
15	Close Mains Output Pulse
16	Combined Mains Failure
17	Common Alarm
18	Common Electrical Trip
19	Common Shutdown
20	Common Warning
21	Cooling Down
22	Digital Input A
23	Digital Input B
24	Digital Input C
25	Digital Input D
26	RESERVED
27	RESERVED
28	RESERVED
29	Emergency Stop
30	Energise To Stop
31	Fail To Start
32	Fail To Stop
33	Fuel Relay
34	Gas Choke On
35	Gas Ignition
36	Generator Available
37	Generator Over Voltage Shutdown
38	Generator Under Voltage Shutdown
39	kW Overload Alarm
40	Over Current Immediate Warning
41	Delayed Over Current Trip Alarm
42	High Coolant Temperature Shutdown
43	Low Oil Pressure Shutdown
44	Mains High Frequency
45	Mains High Voltage
46	Mains Low Frequency
47	Mains Low Voltage
48	Oil Pressure Sensor Open Circuit

Continued overleaf...



Front Panel Configuration

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Output Sources	
49	Open Gen Output
50	Open Gen Output Pulse
51	Open Mains Output
52	Open Mains Output Pulse
53	Over Frequency Shutdown
54	Over Speed Shutdown
55	Preheat During Preheat Timer
56	Preheat Until End Of Crank
57	Preheat Until End Of Safety Timer
58	Preheat Until End Of Warming
59	Smoke Limiting
60	Start Relay
61	Temperature Sensor Open Circuit
62	Under Frequency Shutdown
63	Under Speed Shutdown
64	Waiting For Manual Restore
65	Flexible Sensor C High Alarm
66	Flexible Sensor C High Alarm
67	Flexible Sensor C Low Pre-Alarm
68	Flexible Sensor C Low Alarm
69	RESERVED
70	RESERVED
71	RESERVED
72	RESERVED
73	Fuel Sensor High Alarm
74	Fuel Sensor High Alarm
75	Fuel Sensor Low Pre-Alarm
76	Fuel Sensor Low Alarm
77	Delayed Load Output 1
78	Delayed Load Output 2
79	Delayed Load Output 3
80	Delayed Load Output 4
81	Air Filter Maintenance Output
82	Oil Filter Maintenance Output
83	Fuel Filter Maintenance Output
84	System In Stop Mode
85	System In Auto Mode
86	System In Manual Mode
87	RESERVED
88	Analogue Input A (Digital)
89	Analogue Input B (Digital)
90	Analogue Input C (Digital)
91	RESERVED
92	RESERVED
93	RESERVED
94	RESERVED
95	Over Speed Overshoot
96	Over Frequency Overshoot
97	Display Heater Fitted and Active
98	RESERVED
99	SCR Inducement

Continued overleaf...



Front Panel Configuration

	Functionality in DSE4510 MKII & DSE4520 MKII
	Functionality in DSE4520 MKII only.

Output Sources	
100	DEF Level Low Active
101	DPF Auto Regeneration Inhibit
102	DPF Forced Regeneration
103	DPF None Mission State
104	DPF Regeneration in Progress
105	DPF Regeneration Interlock Active
106	DPTC Filter
107	HEST Active
108	Water in Fuel



6.6.3 ALARM ACTION

Alarm Action	
Index	Action
0	Electrical Trip
1	Shutdown
2	Warning

6.6.4 POWER UP MODE

Power Up Mode	
Index	Mode
0	Stop
1	Manual
2	Auto

6.6.5 SENSOR TYPE

Sensor Type	
Index	Type
0	None
1	Digital Input
2	Percentage Sensor
3	Pressure Sensor
4	Temperature Sensor

6.6.6 AC SYSTEM

AC System	
Index	Type
0	2 Phase 3 Wire (L1-L3)
1	2 Phase 3 Wire (L1-L2)
2	3 Phase 3 Wire
3	3 Phase 4 Wire
4	3 Phase 4 Wire (Delta)
5	Single Phase 2 Wire

6.6.7 DIGITAL INPUT ALARM ARMING

Digital Input Alarm Arming	
Index	Arming
0	Always
1	From Safety On
2	From Starting
3	Never



6.6.8 DIGITAL INPUT POLARITY

Digital Input Polarity	
Index	Polarity
0	Close to Activate
1	Open to Activate

6.6.9 OUTPUT POLARITY

Output Polarity	
Index	Polarity
0	Energise
1	De-Energise

6.6.10 PRESSURE SENSOR LIST

Pressure Sensor List	
Index	Type
0	Not used
1	Dig Closed for Alarm
2	Dig Open for Alarm
3	VDO 5 Bar
4	VDO 10 Bar
5	Datcon 5 Bar
6	Datcon 10 Bar
7	Datcon 7 Bar
8	Murphy 7 Bar
9	CMB812
10	Veglia
11	User Defined

6.6.11 TEMPERATURE SENSOR LIST

Temperature Sensor List	
Index	Type
0	Not Used
1	Dig Closed for Alarm
2	Dig Open for Alarm
3	VDO 120 °C
4	Datcon High
5	Datcon Low
6	Murphy
7	Cummins
8	PT100
9	Veglia
10	Beru
11	User Defined



6.6.12 PERCENTAGE SENSOR LIST

Percentage Sensor List	
Index	Type
0	Not Used
1	Dig Closed for Alarm
2	Dig Open for Alarm
3	VDO Ohm (10-180)
4	VDO Tube (90-0)
5	US Ohm (240-33)
6	GM Ohm (0-90)
7	GM Ohm (0-30)
8	Ford (73-10)
9	User Defined



7 COMMISSIONING

 **NOTE:** If Emergency Stop feature is not required, link the input to the DC Negative or disable the input. For further details of module configuration, refer to DSE Publication: **057-258 DSE4510 MKII & DSE4520 MKII Configuration Software Manual.**

Before the system is started, it is recommended that the following checks are made:

- The unit is adequately cooled and all the wiring to the module is of a standard and rating compatible with the system. Check all mechanical parts are fitted correctly and that all electrical connections (including earths) are sound.
- The unit DC supply is fused and connected to the battery and that it is of the correct polarity.
- The Emergency Stop input is wired to an external **normally closed** switch connected to **DC negative**.
- To check the start cycle operation, take appropriate measures to prevent the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. Press the **Manual/Start Mode**  button, the unit start sequence commences.
- The starter engages and operates for the pre-set crank period. After the starter motor has attempted to start the engine for the pre-set number of attempts, the LCD displays **Fail to Start** . Press the **Stop/Reset Mode**  button to reset the unit.
- Restore the engine to operational status (reconnect the fuel solenoid). Press the **Manual/Start Mode**  button. This time the engine should start and the starter motor should disengage automatically. If not then check that the engine is fully operational (fuel available, etc.) and that the fuel solenoid is operating. The engine should now run up to operating speed. If not, and an alarm is present, check the alarm condition for validity, then check input wiring. The engine should continue to run for an indefinite period. It is possible at this time to view the engine and alternator parameters - refer to the 'Description of Controls' section of this manual.
- Press the **Auto Mode**  button, the engine runs for the pre-set cooling down period, then stop. The generator should stay in the standby mode. If it does not, check that the *Remote Start* input is not active.
- Initiate an automatic start by supplying the remote start signal (if configured). The start sequence commences and the engine runs up to operational speed. Once the generator is available the delayed load outputs activate, the Generator accepts the load. If not, check the wiring to the delayed load output contactors. Check the Warming timer has timed out.
- Remove the remote start signal. The return sequence begins. After the pre-set time, the generator is unloaded. The generator then runs for the pre-set cooling down period, then shutdown into its standby mode.
- Set the modules internal clock/calendar to ensure correct operation of the scheduler and event logging functions. For details of this procedure see section entitled *Front Panel Configuration*.
- If, despite repeated checking of the connections between the controller and the customer's system, satisfactory operation cannot be achieved, then contact DSE Technical Support Department. E-mail: support@deepseapl.com



8 FAULT FINDING

 **NOTE:** The below fault finding is provided as a guide check-list only. As the module can be configured to provide a wide range of different features, always refer to the source of the module configuration if in doubt.

8.1 STARTING

Symptom	Possible Remedy
Unit is inoperative	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Read/Write configuration does not operate	
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 9 Volts Check the operating temperature is not above 70°C. Check the DC fuse.
Fail to Start  is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the module. Check the speed-sensing signal is present on the module's inputs. Refer to engine manual.
Continuous starting of generator when in the Auto Mode 	Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. Check signal is on "Remote Start" input. Confirm correct configuration of input is configured to be used as "Remote Start". Check that the oil pressure switch or sensor is indicating low oil pressure to the controller. Depending upon configuration, the set does not start if oil pressure is not low.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure oil pressure switch or sensor is indicating the "low oil pressure" state to the controller.

8.2 LOADING

Symptom	Possible Remedy
Engine runs but generator does not take load	Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check connections to the switching device. Note that the set does not take load in Manual/Start Mode  unless there is an active load signal.
Incorrect reading on engine gauges	Check engine is operating correctly.
Fail To Stop  when engine is at rest	Check that sensor is compatible with the module and that the module configuration is suited to the sensor.



8.3 ALARMS

Symptom	Possible Remedy
Low Oil Pressure  operates after engine has fired	Check engine oil pressure. Check oil pressure switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the module and is correctly configured.
High Coolant Temperature  operates after engine has fired.	Check engine temperature. Check switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the module.
Shutdown fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Electrical Trip fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
CAN ECU Amber  CAN ECU Red 	This indicates a fault condition detected by the engine ECU and transmitted to the DSE controller.
CAN Data Fail 	Indicates failure of the CAN data link to the engine ECU. Check all wiring and termination resistors (if required).
Incorrect reading on Engine gauges	Check engine is operating correctly. Check sensor and wiring paying particular attention to the wiring to terminal 10.
Fail To Stop  when engine is at rest	Check that sensor is compatible with the module and that the module configuration is suited to the sensor.

8.4 COMMUNICATIONS

Symptom	Possible Remedy
CAN Data Fail 	Indicates failure of the CAN data link to the engine ECU. Check all wiring and termination resistors (if required).

8.5 INSTRUMENTS

Symptom	Possible Remedy
Inaccurate generator measurements on controller display	Check that the CT primary, CT secondary and VT ratio settings are correct for the application. Check that the CTs are wired correctly with regards to the direction of current flow (p1,p2 and s1,s2) and additionally ensure that CTs are connected to the correct phase (errors occur if CT1 is connected to phase 2). Remember to consider the power factor ($kW = kVA \times \text{powerfactor}$). The controller is true RMS measuring so gives more accurate display when compared with an 'averaging' meter such as an analogue panel meter or some lower specified digital multimeters. Accuracy of the controller is better than 1% of full scale. Generator voltage full scale is 415 V ph-N, accuracy is ± 4.15 V (1 % of 415 V).



8.6 MISCELLANEOUS

Symptom	Possible Remedy
Module appears to 'revert' to an earlier configuration	When editing a configuration using the PC software it is vital that the configuration is first 'read' from the controller before editing it. This edited configuration must then be "written" back to the controller for the changes to take effect. When editing a configuration using the fascia editor, be sure to press the Auto Mode  (✓) button to save the change before moving to another item or exiting the fascia editor



9 MAINTENANCE, SPARES, REPAIR AND SERVICING

The controller is *Fit and Forget*. As such, there are no user serviceable parts within the controller. In the case of malfunction, you should contact your original equipment manufacturer (OEM).

9.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

If you require additional plugs from DSE, please contact our Sales department using the part numbers below.

9.1.1 PACK OF PLUGS

Module Type	Plug Pack Part Number
DSE4510 MKII	100-400-47
DSE4520 MKII	100-400-46

9.1.2 INDIVIDUAL PLUGS

Module Terminal Designation	Plug Description	Part No.
1-9	9 way 5.08mm	007-166
10-20	11 way 5.08mm	007-451
21-24	4 way 10.16mm	007-003
25-28 DSE4520 MKII Only	4 way 10.16mm	007-003
29-32	4 way 5.08mm	007-282
	PC Configuration interface lead (USB type A – USB type B)	016-125

9.2 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

Item	Description	Part No.
	Module Fixing Clips (Packet Of 2)	020-406

9.3 PURCHASING ADDITIONAL SEALING GASKET FROM DSE

Item	Description	Part No.
	Module Silicon Sealing Gasket	020-282



10 WARRANTY

DSE Provides limited warranty to the equipment purchaser at the point of sale. For full details of any applicable warranty, refer to the original equipment supplier (OEM)

11 DISPOSAL

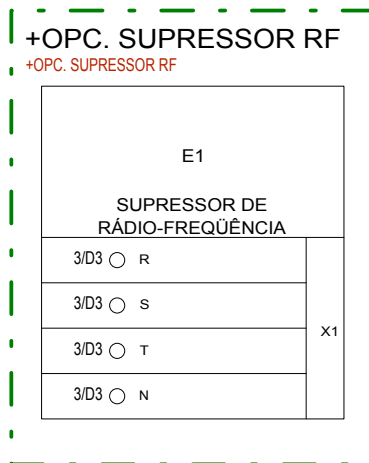
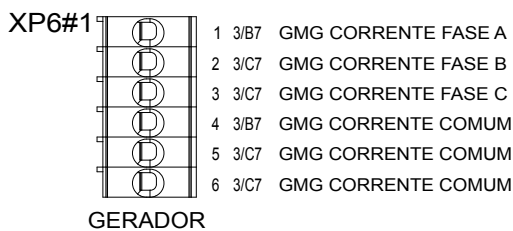
11.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

If you use electrical and electronic equipment you must store, collect, treat, recycle and dispose of WEEE separately from your other waste



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 FUSÍVEL ORIGINAL DO GERADOR CONFORME MODELO DO ART - REGULADOR AUTOMÁTICO DE TENSÃO.

 REGULADOR AUTOMÁTICO DE TENSÃO ORIGINAL DEVERÁ SER REMOVIDO DA BASETA E INSTALADO NO QUADRO.

3 EM 220VCA, CONECTAR ENTRADA DE REALIMENTAÇÃO NO PINO E1 DO REGULADOR.
EM 380/440VCA, CONECTAR ENTRADA DE REALIMENTAÇÃO NO PINO E2 DO REGULADOR.

▲ INSTALAR O CHICOTE DE EXTENSÃO NO REGULADOR DE TENSÃO CONFORME A NUMERAÇÃO DOS CABOS ORIGINAIS DO GERADOR.



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05	PF	28/04/2023	GONÇALVES	DAVID	FABIANO	UMSZA	FREDDY	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
04	PF	09/03/2023	GONÇALVES	DAVID	FABIANO	UMSZA	FREDDY	
03	PF	24/01/2023	DAVID	DAVID	FABIANO	UMSZA	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	EMISSIONES PADRONIZADAS
 www.stemac.com (51) 2131.3800			CLIENTE: PADRÃO					ESCALA: S/E
			OBRA: PADRÃO					UNIDADE: --
			TÍTULO: AMOSTRAS DE TENSÃO E CORRENTE DO GERADOR S/ SINCR ARQUITETURA DE MÓDULOS VERSÃO SPRINT					PÁGINA: 2 de 4
			Este documento é de propriedade exclusiva da STEMAC S/A. O uso indevido e/ou não autorizado poderá acarretar em ações legais. Assinado digitalmente conforme art. 4º, II da Lei nº 13.709/2019					CÓDIGO STEMAC: _____
								A3

A

B

C

D

E

F

A

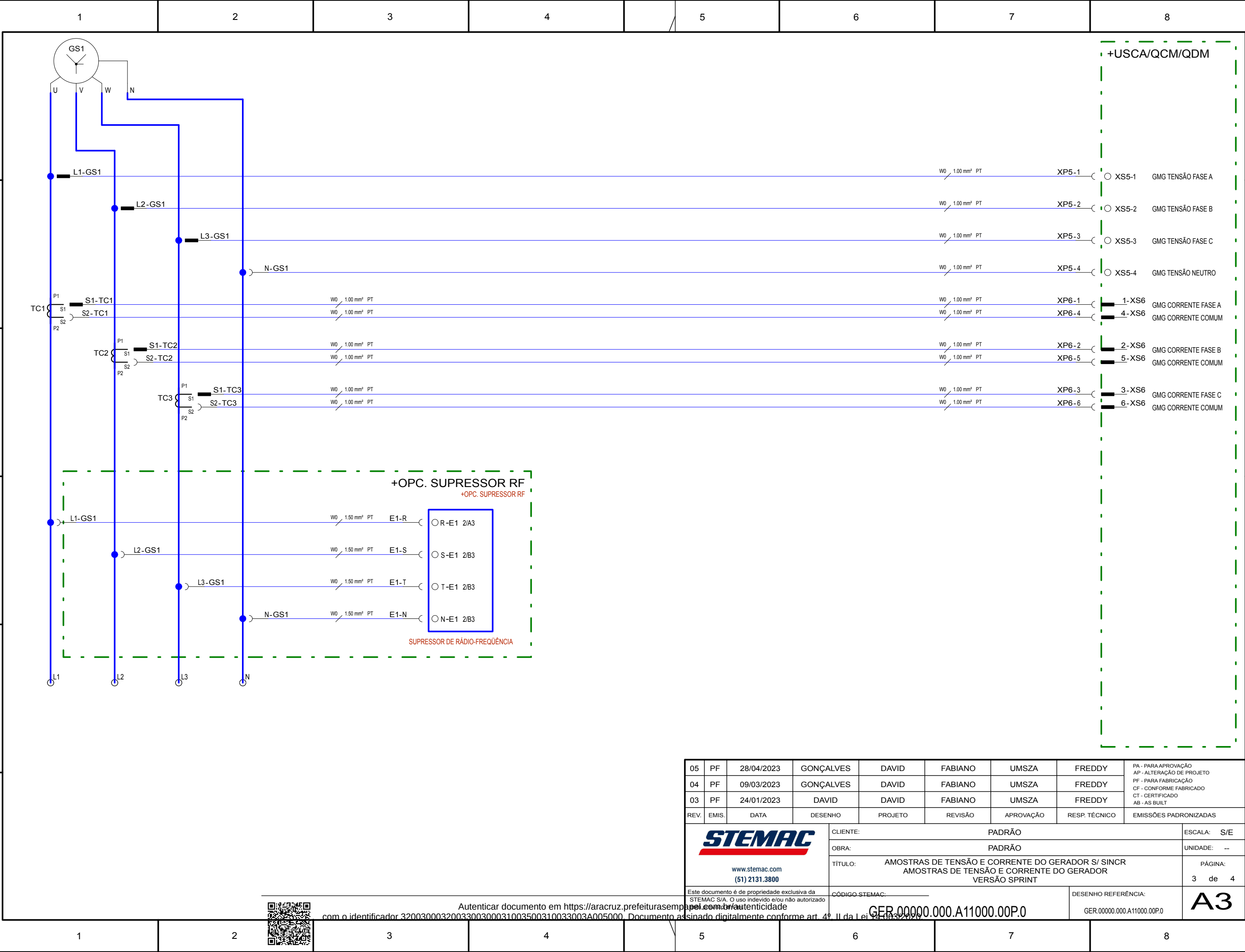
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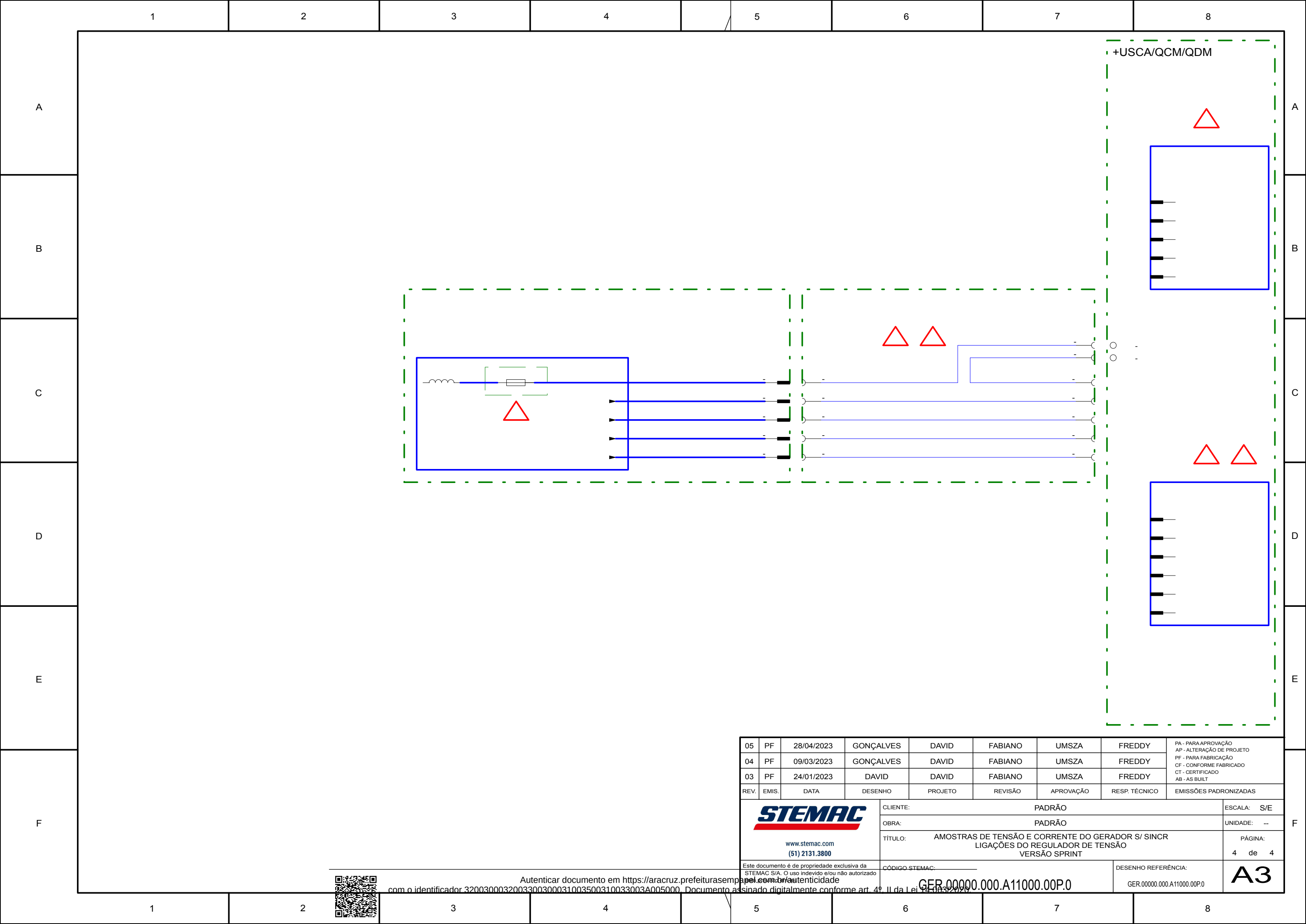
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F



05	PF	28/04/2023	GONÇALVES	DAVID	FABIANO	UMSZA	FREDDY	PA - PARA APROVAÇÃO AP - ALTERAÇÃO DE PROJETO PF - PARA FABRICAÇÃO CF - CONFORME FABRICADO CT - CERTIFICADO AB - AS BUILT
04	PF	09/03/2023	GONÇALVES	DAVID	FABIANO	UMSZA	FREDDY	
03	PF	24/01/2023	DAVID	DAVID	FABIANO	UMSZA	FREDDY	
REV.	EMIS.	DATA	DESENHO	PROJETO	REVISÃO	APROVAÇÃO	RESP. TÉCNICO	
 www.stemac.com (51) 2131.3800			CLIENTE: PADRÃO					ESCALA: S/E
			OBRA: PADRÃO					UNIDADE: --
			TÍTULO: AMOSTRAS DE TENSÃO E CORRENTE DO GERADOR S/ SINCR AMOSTRAS DE TENSÃO E CORRENTE DO GERADOR VERSÃO SPRINT					PÁGINA: 3 de 4
			Este documento é de propriedade exclusiva da STEMAC S/A. O uso indevido e/ou não autorizado poderá acarretar a perda da validade e a nulidade do documento.					CÓDIGO STEMAC: GER.00000.000.A11000.00P.0
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A SUA SOLUÇÃO EM ENERGIA

MANUAL de Instalação, Operação e Manutenção



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ATENÇÃO

- 1- Leia este manual antes de operar o equipamento.
- 2- Mantenha o manual protegido e próximo ao Grupo Gerador.
- 3- Tenha em mãos o número de série do(s) seu(s) equipamento(s), caso necessite entrar em contato com nossos serviços.
- 4- Os termos de garantia estão disponíveis no site para download: www.stemac.com/pt/servicos-pecas
- 5- Ligue 0300 789 38 00 e agende a Entrega Técnica do seu equipamento. Para maiores informações consulte a página 43 deste manual.





MANUAL de Instalação, Operação e Manutenção





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MENSAGEM DE BOAS-VINDAS AO CLIENTE

Parabéns!

Você adquiriu um produto com a qualidade STEMAC, empresa líder na fabricação e comercialização de grupos geradores e certificada com a ISO 9001. Os equipamentos STEMAC são submetidos a rigorosos testes para garantir aos nossos clientes produtos com a maior confiabilidade.

Este manual contém informações de instalação, operação e manutenção necessárias para você operar o grupo gerador com segurança e de forma adequada, bem como os canais de comunicação STEMAC que oferecem o mais completo atendimento de pós venda. Leia com atenção.

STEMAC S.A Grupos Geradores





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APRESENTAÇÃO DO EQUIPAMENTO

As grandes marcas internacionais de motores e geradores equipam os grupos geradores STEMAC, proporcionando ao cliente a melhor relação custo-benefício em cada faixa de potência.

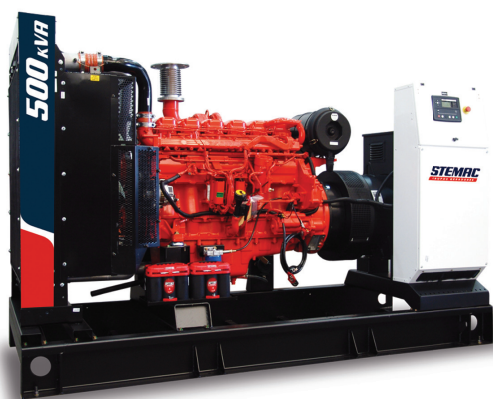
Compostos por motores de reconhecida performance, acoplados a geradores de moderna tecnologia e montados sobre base metálica, com acionamento automático ou manual. Proteção opcional contra intempéries, com ou sem carenagens silenciadas, disponíveis tanto em unidades móveis como estacionárias.

Podem ser utilizados de forma singela ou em paralelo com outros grupos geradores, formando usinas

de até 30 MVA. Os Grupos Geradores STEMAC são projetados com características especiais que os tornam apropriados para diversas aplicações.

Os grupos geradores STEMAC Carenados e Silenciados são especialmente projetados para as mais rigorosas aplicações, atendendo aos limites acústicos exigidos em áreas críticas (hospitais, eventos, residenciais, entre outros).

Os contêineres possibilitam uma rápida instalação e não requerem obras civis permitindo mobilidade para eventuais remanejos. Os contêineres STEMAC são produzidos em cinco versões, sendo quatro atenuadas e uma não atenuada.



de 25 a 3438 kVA



na versões 65/75/85dB(A)@1,5m



GRUPO GERADOR ABERTO

ESPECIFICAÇÕES BÁSICAS

- 1 BASE**
 - Base fabricada em perfis de aço carbono, com pintura de fundo primer epóxi e acabamento em poliuretano acrílico na cor preto semi-brilho;
 - Excelente rigidez mecânica;
 - Montagem de todos os compoentes limitados às faces externas da base, facilitando o transporte.
- 2 AMORTECEDORES**
 - Instalados entre a base e o motor e gerador;
 - Resistência durante o transporte.
- 3 TANQUE DE COMBUSTÍVEL**
 - Instalado na base, fabricado com formato retangular;
 - Tanque dotado de janela de inspeção aparafusada, com conexões de alimentação, retorno e instrumentação localizados no próprio flange;
 - Estrutura interna reforçada, apresenta elevada resistência mecânica.
- 4 BATERIA DE PARTIDA**
 - Montagem em suporte sobre a base.
- 5 QUADRO DE COMANDO**
 - Quadro de comando e de força Gemini instalado sobre a base;
 - Painel frontal com abertura vertical, facilitando a visualização e operação, sustentado por amortecedores;
 - Compartimento de comando e força separados, apresentando maior segurança na operação e manutenção, além de atender a NR10;
 - Abertura para passagem de cabos elétricos entre painel e bazeta do gerador com borracha de proteção mecânica, protege a integridade do cabo contra entrada de objetos indesejados no interior do painel;
 - Suporte do quadro com inclinação, facilita a entrada e fixação dos cabos elétricos.



CARENADOS E SILENCIADOS

ESPECIFICAÇÕES BÁSICAS

CARENADOS

Todos os modelos possuem entrada de ar lateral e traseira por sistema cruzado e saída frontal por veneziana de proteção.

SILENCIADOS

Projetados para atenuar ruídos até 85dBA @ 1,5m, são fornecidos com entrada de ar lateral e traseira por sistema cruzado e saída frontal com exaustão vertical.

SUPER SILENCIADOS

Projetados para atenuar ruídos até 75dBA @ 1,5m, para potências até 260kVA, são fornecidos com entrada de ar lateral e traseira por sistema cruzado e saída frontal com exaustão vertical (mesma concepção do SL). Nas potências a partir de 290kVA, entrada de ar pela traseira e saída frontal com exaustão horizontal, através de atenuadores de ruído nas aberturas. Tratamento acústico interno, com material fonoabsorvente em espuma poliuretano de células abertas autoextinguível.



1 CARENAGEM

É composta por painéis laterais, teto e quatro portas reforçadas com perfis metálicos, na cor BRANCA, permitindo o acesso ao motor e quadro elétrico.

2 BASE

De construção rígida para assentamento do grupo gerador, são fabricadas em chapas e perfis de aço carbono e com pintura de fundo epóxi, na cor PRETA. Dotadas de reforços centrais nas longarinas e alças nas extremidades garantem uma movimentação sem deflexões.

3 QUADRO DE COMANDO

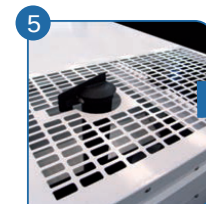
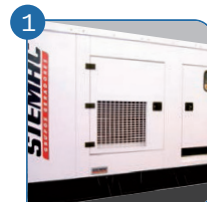
Instalado no interior do contêiner, compartimento de comando e de força separados, isolado acusticamente e acesso externo.

4 TANQUE DE COMBUSTÍVEL

Fabricado em polietileno, é instalado na base sob o grupo gerador completamente interligado com o motor.

5 ESCAPAMENTO

Instalado dentro do contêiner, com saída no teto através de tampa oscilante.



2. Atendimento e identificação

Prezado cliente,

Ao adquirir produtos STEMAC você passa a contar com serviços personalizados de nossa Divisão de Serviços e Peças (DSP):



Entrega Técnica: primeira partida do grupo gerador realizada nas dependências do cliente, executada por técnicos da STEMAC, garantindo segurança e perfeito funcionamento dos equipamentos.

Manutenção Preventiva: : serviço oferecido pela STEMAC de forma planejada de acordo com a necessidade de cada cliente, onde desenvolvemos módulos de atendimentos programados e periódicos que garantem a confiabilidade e disponibilidade dos equipamentos.

Manutenção Corretiva: a STEMAC oferece a seus clientes serviço de telediagnose com técnicos especializados que através do Canal Nacional de Serviços e Peças, identificam e solucionam eventuais falhas, encaminhando para atendimento em campo quando necessário.

Atendimento

2.1 Canal Nacional de Serviços e Peças



0300 789 3800*

**SUORTE TÉCNICO 24h
COMPRA DE PEÇAS E
CONTRATAÇÃO DE SERVIÇOS**

**custo de uma ligação local*

A STEMAC disponibilizou uma linha exclusiva, 24 horas e 7 dias da semana, para você solicitar atendimento técnico e comprar peças para seu grupo gerador, através no número 0300 789 38 00. Ao entrar em contato conosco, tenha em mãos o nº do motor e/ou gerador e garanta um atendimento ágil e a maior vida útil ao seu equipamento.

2.2 Objetivos

Disponibilizar aos clientes STEMAC um canal exclusivo para o acesso a solicitações de serviços e peças, onde pode ser obtido atendimento para solicitações de informações técnicas, serviços de entrega técnica dos equipamentos, manutenções corretivas, preventivas, compra de peças e contratação de serviços.



2.3 Informações

Esclarecimento sobre cada uma das cinco opções disponíveis:

- a) Solicitar atendimento técnico: utilizar para a solicitação de informações técnicas sobre os grupos geradores, solicitações serviços de entrega técnica, manutenção corretiva e preventiva;
- b) Informações sobre o atendimento: utilizar para obter informações sobre a programação dos serviços solicitados. Necessariamente deverá ter existido um contato prévio do cliente onde foi solicitado o serviço e gerado protocolo Ordem de Serviço (OS);
- c) Comprar serviços e peças: utilizar para a compra exclusiva de peças e contratos de manutenção preventiva;
- d) Registrar crítica ou sugestões através do canal de atendimento ao cliente (SAC), telefone 0800 702 38 00;
- e) Falar com atendentes: telefonistas.

2.4 Identificação

Quando o cliente necessitar obter informação ou solicitar atendimento é importante para agilizar a identificação ter em mãos dados do equipamento (número do motor, gerador, ST ou CNPJ).

2.5 Fluxo de Serviço

Esclarecer ao cliente sobre os fluxos do atendimento e procedimentos para equipamentos em:

- a) Garantia c/ônus: será enviada tabela técnica ao cliente com os custos de deslocamento e despesas para aprovação previa antes do atendimento;
- b) Pós garantia: será enviado orçamento ao cliente com os custos do atendimento para aprovação prévia antes do atendimento;
- c) Preventiva: será executado atendimento e em caso de necessidade de substituição de peças será encaminhado ao cliente orçamento para aprovação.

2.6 Protocolos de Atendimento

Orientação sobre os registros de atendimento:

- a) N° do chamado: registro do atendimento efetuado pelo call center , deve ser solicitado pelo cliente e utilizado em caso de novo contato enquanto estiver tratando sobre o mesmo assunto, agilizando assim o acesso ao histórico de informações que foram passadas previamente;
- b) N° da EDV: registro da solicitação de Orçamento;
- c) N° da OS: registro de uma Ordem de serviço;
- d) N° do RAT: registro do relatório de Serviços.



3. Transporte, Recebimento, Armazenamento e Desembalagem

3.1 Transporte

Responsabilidade: o transporte dos Grupos Geradores (GMG's) poderá ser realizado pela STEMAC ou pelo cliente, conforme negociação comercial. Quando o transporte for realizado pela STEMAC, este poderá ser com frota própria ou terceirizado, por um fornecedor que atenda as necessidades de transporte dos produtos STEMAC.

Fixação sobre o caminhão: os GMG's são fixados sobre a carroceria do caminhão por cintas, catracas, tirantes, tacos, etc., de modo que fique totalmente fixo e se respeitando o espaçamento necessário para não ocorrer avarias no transporte.

Requisitos do caminhão: que esteja em perfeitas condições para rodar. Para acomodar e fixar de modo correto e seguro os GMG's.

Demais cuidados no transporte: o transporte dos GMG's e acessórios deve ser feito com proteção às intempéries do tempo. Os Quadros de Comando devem ter um cuidado especial, por se tratar de equipamento com componentes eletroeletrônicos sensíveis.

Seguro: quando o transporte for de responsabilidade da STEMAC a carga fica completamente segurada, porém quando transportada pelo cliente o seguro fica a critério do mesmo.

3.2 Recebimento

Inspeção da carga antes de descarregar: quando o transporte é realizado pela STEMAC, no momento da entrega o motorista irá realizar uma inspeção visual do estado do GMG em conjunto com o responsável pelo recebimento do

cliente. Devem ser confirmados os componentes do GMG que está sendo entregue de acordo com o descrito na Nota Fiscal. Em caso de verificação de alguma diferença em componentes ou avaria, em ambos os casos deve ser sinalizado no canhoto da NF, no conhecimento de transporte da transportadora e no comprovante de entrega (documento STEMAC discriminando quantidade de volumes e itens a serem recebidos).

3.3 Descarregamento

Cuidados ao descarregar: ao descarregar o GMG será necessário a utilização de caminhão munck, guindaste ou empilhadeira.

Para tanto, deve-se ter alguns cuidados, como:

- ✓ verificar o peso do equipamento e capacidade de carga do veículo;
- ✓ verificar condições gerais de funcionamento do veículo;
- ✓ utilizar operador habilitado e com disponibilidade integral para o serviço;
- ✓ verificar se as sapatas do veículo estão firmemente apoiadas;
- ✓ verificar as condições de cabos de aço, cintas e cordas;
- ✓ verificar etiquetas ilustrativas para descarregamento (figuras).

Deve-se utilizar os olhais de içamento das cargas, quando for aplicado, para fixação dos cabos do munck ou guindaste.

Os GMG's que são montados em containeres possuem local específico na sua base, onde devem ser fixados os cabos de aço do guincho ou onde deve ser suspenso pelos garfos da empilhadeira. Em caso de içamento com cintas, devem



ser utilizadas cintas duplas entrelaçadas e também balancim (espaçadores) para evitar danos na carenagem externa.

Os GMG's menores vêm instalados sobre um chassi que possui etiquetas indicativas dos pontos para içamento e/ou introdução dos garfos da empilhadeira.

Nos GMG's de maior dimensão deverá ser utilizado roletes nas bases para prender os cabos ou cintas para içamento. Também deve ser verificada a necessidade de balancim (espaçadores) para os cabos ou cintas não danificar nenhum componente periférico do grupo, ou carenagem externa, no caso específico de containeres:

- Atentar no equipamento (Grupo Gerador) a presença da etiqueta ao lado.
- O equipamento (Grupo Gerador) não pode ser içado pela alça do gerador ou pelo motor;
- Somente içar o Equipamento conforme previsto neste capítulo.
- Qualquer outra forma de içamento pode danificar o equipamento, bem como trazer risco à segurança.

3.4 Armazenamento

Cuidados no armazenamento até a instalação: sempre que o GMG ficar por longos períodos de inatividade e armazenado na propriedade do cliente, em local diferente da sua instalação final, deve-se manter o mesmo coberto, livre de umidade e poeira, preferencialmente em ambientes fechados. Na inexistência de local adequado descrito anteriormente, o cliente deve providenciar imediatamente após descarga, o enlonação dos equipamentos e acessórios de modo a se ter proteção às intempéries do tempo e impregnação de poeira. No caso dos equipamentos ficarem instalados em locais onde estão ou estarão sendo executadas obras civis, além dos cuidados descritos acima, os equipamentos devem ficar devidamente protegidos de caliças, entulhos e áreas de circulação de material, de forma a não danificar

os equipamentos. Casos onde fique comprovado o não cumprimento dos devidos cuidados de armazenamento por parte do cliente, a garantia do equipamento pode ser afetada, bem como eventuais custos de consertos serem de responsabilidade do cliente.

Observar nos manuais específicos cuidados com relação a longos períodos de inatividade.

Após 90 dias de armazenamento do grupo gerador, o início das operações é considerado como ativação. Neste caso serão realizadas na Entrega Técnica as verificações de óleo, bateria, gerador, etc; e estes custos serão por conta do cliente.

3.5 Desembalagem

Que tipo de embalagem é usada: o GMG pode ser embalado por uma camada de plástico bolha, filme plástico, normalmente nos itens que possuem superfície com pintura de acabamento, incluindo os atenuadores de ruído. Os Quadros de Comando são transportados embalados com plástico bolha e com embalagem de madeira externa.

Como desembalar: removendo o plástico bolha manualmente e retirando a estrutura de madeira.

Ao desembalar o equipamento verifique as condições gerais observando possíveis avarias e verificando a documentação que acompanha o mesmo.

Destinação do material de embalagem: após a desembalagem, os materiais remanescentes (plástico, madeira, etc.) devem ser devidamente encaminhados para destinação final de resíduos, conforme política adotada pelo cliente.



4. Segurança

Nas instalações e serviços em eletricidade, devem ser observadas no projeto, execução, operação, manutenção, reforma e ampliação, as normas técnicas oficiais estabelecidas pelos órgãos competentes e, na falta destas, as normas internacionais vigentes.

4.1 Instalações

4.1.1 Proteção contra o risco de contato

- Todas as partes das instalações elétricas devem ser projetadas e executadas de modo que seja possível prevenir, por meios seguros, os perigos de choque elétrico e todos os outros tipos de acidentes.
- As partes de instalações elétricas a serem operadas, ajustadas ou examinadas, devem ser dispostas de modo a permitir um espaço suficiente para trabalho seguro.
- As partes das instalações elétricas, não cobertas por material isolante, na impossibilidade de se conservarem distâncias que evitem contatos casuais, devem ser isoladas por obstáculos que ofereçam, de forma segura, resistência a esforços mecânicos usuais.
- Toda instalação ou peça condutora que não faça parte dos circuitos elétricos, mas que, eventualmente, possa ficar sob tensão, deve ser aterrada, desde que esteja em local acessível a contatos.
- O aterramento das instalações elétricas devem ser executado obedecendo às normas técnicas oficiais estabelecidas pelos órgãos competentes e, na falta destas, as normas internacionais vigentes.
- As instalações elétricas que estejam em contato direto ou indiretas com a água e que possam permitir fuga de corrente devem ser projetadas e executadas, obedecendo às normas técnicas oficiais estabelecidas pelos

órgãos competentes e, na falta destas, as normas internacionais vigentes, em especial quanto à blindagem, estanqueidade, isolamento e aterramento.

4.2 Serviços

4.2.1 Proteção do trabalhador

- No desenvolvimento de serviços em instalações elétricas, devem ser previstos Sistemas de Proteção Coletiva - SPC, através de isolamento físico de áreas, sinalização, aterramento provisório e outros similares, nos trechos onde os serviços estão sendo desenvolvidos.
- Quando, no desenvolvimento dos serviços, os sistemas de proteção coletiva forem insuficientes para o controle de todos os riscos de acidentes pessoais, devem ser utilizados Equipamentos de Proteção Coletiva - EPC e Equipamentos de Proteção Individual - EPI, tais como varas de manobra, escadas, detectores de tensão, cintos de segurança, capacetes e luvas, observadas as prescrições previstas nas normas técnicas oficiais estabelecidas pelos órgãos competentes e, na falta destas, as normas internacionais vigentes.
- As ferramentas manuais utilizadas nos serviços em instalações elétricas devem ser eletricamente isoladas, merecendo especiais cuidados as ferramentas e outros equipamentos destinados a serviços em instalações elétricas sob tensão.

4.2.2 Procedimentos

Os grupos geradores não devem operar com carga muito abaixo da sua capacidade nominal, sob risco de trazer danos ao motor e também re-



duzir sua vida útil.

Os motores diesel são projetados e seus componentes internos normalmente dimensionados para condições de carga próximas da nominal, ocasião em que seus sistemas internos atingem temperaturas cujas dilatações térmicas permitem vedações mais eficientes, como é o caso dos anéis de vedação dos cilindros do motor. Com cargas reduzidas, os sistemas de água de arrefecimento, óleo lubrificante e outros, trabalham em temperaturas mais baixas, caracterizando uma anomalia às condições do equipamento.

Muito embora dar-se ênfase de que cargas inferiores a 30% são proibitivas, outras cargas reduzidas, mesmo que superiores a indicada, igualmente podem implicar nos seguintes problemas :

- maior consumo específico de óleo lubrificante
- maior consumo específico de óleo combustível
- surgimento de óleo na tubulação de gases de descarga
- desgaste prematuro de anéis e espelhamento de camisas

Os riscos de problemas e intensidade dos desgastes no motor, estarão diretamente associados ao tempo de operação que o grupo gerador ficar submetido a estas condições de baixa carga.

Em particular, além de danos ao motor, a operação com baixa carga também pode provocar acúmulo de óleos não queimados pelo motor no interior do silencioso da tubulação de gases de descarga. Esta situação pode trazer risco de explosão ao silencioso, caso o motor passe a operar com cargas elevadas e consequentes altas temperaturas no interior desse acessório.

- Durante a construção ou reparo de instalações elétricas ou obras de construção civil, próximas de instalações sob tensão, devem ser tomados cuidados especiais quanto ao risco de contatos eventuais e de indução elétrica.
- Quando forem necessários serviços de manutenção em instalações elétricas sob tensão, estes deverão ser planejados e programados, determinando-se todas as operações que envolvam riscos de acidente, para que possam ser estabelecidas as medidas preventivas necessárias.

- Toda ocorrência, não programada, em instalações elétricas sob tensão deve ser comunicada ao responsável por essas instalações, para que sejam tomadas as medidas cabíveis.
- É proibido acesso e permanência de pessoas não autorizadas em ambientes próximos a partes das instalações elétricas que ofereçam riscos de danos às pessoas e às próprias instalações.
- Os serviços de manutenção ou reparo em partes de instalações elétricas que não estejam sob tensão, só podem ser realizados quando as mesmas estiverem liberadas.
- Entende-se por instalação elétrica liberada para estes serviços, aquela cuja ausência de tensão pode ser constatada com dispositivos específicos para esta finalidade.
- Para garantir a ausência de tensão no circuito elétrico, durante todo o tempo necessário para o desenvolvimento destes serviços, os dispositivos de comando devem estar sinalizados e bloqueados, bem como o circuito elétrico aterrado.
- Os serviços de manutenção e/ou reparos em partes de instalações elétricas, sob tensão, só podem ser executados por profissionais qualificados, devidamente treinados, em cursos especializados, com emprego de ferramentas e equipamentos especiais. Observar os requisitos tecnológicos e as prescrições previstas nas normas técnicas oficiais estabelecidas pelos órgãos competentes e, na falta destas, as normas internacionais vigentes.
- As instalações elétricas devem ser inspecionadas por profissionais qualificados, designados pelo responsável pelas instalações elétricas nas fases de execução, operação, manutenção, reforma e ampliação.
- Devem ser colocadas placas de aviso, inscrições de advertência, bandeirolas e demais meios de sinalização que chamem a atenção quanto ao risco das instalações elétricas sob tensão, sujeitas a risco de contato durante os trabalhos de reparação, ou sempre que for julgado necessário.



- Os espaços dos locais de trabalho, situados nas vizinhanças de partes elétricas expostas, não devem ser utilizados como passagem.
- É proibido guardar objetos estranhos próximo às partes condutoras da instalação.
- Devem ser utilizados cordões elétricos alimentados por transformador de segurança ou por tensão elétrica não superior a 24 volts quando da realização de serviços em locais úmidos ou encharcados, bem como quando o piso oferecer condições propícias para condução de corrente elétrica.

4.3 Situações de Emergência

- Os equipamentos automáticos são providos de Botão/Botão de Emergência e deverão ser prontamente acionados, por pessoal responsável em casos de emergência.
- Os equipamentos automáticos também são providos de controladores lógicos programáveis que monitoram a performance do equipamento. Em caso de funcionamento irregular do equipamento, automaticamente ocorrerá seu desligamento.
- Os equipamentos manuais são providos de Botões de Parada ou Chave, que deverão ser prontamente acionados por pessoal responsável em casos de emergência.

4.4 Equipamentos de Proteção Individual (EPI)

Devem ser utilizados quando da instalação, entre-ga técnica, limpeza, manutenção ou movimentação do(s) grupo(s) gerador(es), seja por parte do cliente ou de funcionário STEMAC os equipamentos de proteção aplicáveis a cada situação. Sugerido o demonstrativo abaixo, (Tabela 1)

4.5 Etiquetas de Identificação

4.5.1 Avisos e símbolos de segurança (ANSI Z535 e ISO 3864-2)

ANSI Z535 promove a utilização de avisos de segurança que comuniquem, no próprio desenho ou no símbolo.

O aviso de segurança identifica:

- O perigo
- Meios de evitar o perigo
- Consequências por não evitar o perigo

Existem quatro tipos de avisos descritos na ANSI Z535.5 2007.

- Alerta de Atenção: existência de um perigo.
- Ação Mandatória: ação a ser tomada para evitar o perigo.
- Proibição: ação que não deve ser tomada ou deve ser interrompida.
- Informação: saídas de emergência, local de extintores, rotas de fuga.



4.5.2 Modelos de sinalização.

SINALIZAÇÃO DE ALERTA

Este símbolo transmite informação preliminar relacionada a natureza do perigo e como evitá-lo.

**Alerta****Eletricidade****Choque Elétrico****Material Inflamável****Superfície quente****Água quente ou vapor d'água****Alta Temperatura****Risco de Dano Ambiental****Conexão Terra****Abastecer com Diesel****Dreno****PERIGO
Máquina
com partida
automática****Enchimento****Água quente sob pressão****Perigo
Choque elétrico****Consulte o manual****Perigo
Correias****Perigo
Hélice****SINALIZAÇÃO DE PROIBIÇÃO**

Este símbolo de segurança transmite uma ação que não deve ser executada ou que deve ser interrompida de imediato.

**Não toque
Superfície quente****Somente acesso
autorizado****Não toque com
as mãos molhadas****Não toque****Não içar por
este ponto****SINALIZAÇÃO MANDATÁRIA**

Este símbolo de segurança transmite uma ação que deve ser executada de maneira a evitar o perigo.

**Proteção
para ouvidos****Ponto de
içamento****Proteção
para as mãos****Proteção
para os olhos**

SINALIZAÇÃO DE INFORMAÇÃO



Potência sonora



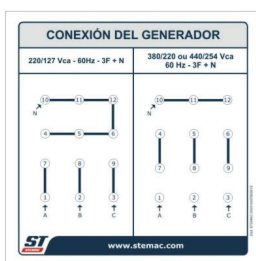
Içamento de containers



Proibido pisar no teto



LIGAÇÕES GERADOR
3 tensões - 12 terminais
Português



LIGAÇÕES GERADOR
3 tensões - 12 terminais
Espanhol



LIGAÇÕES GERADOR
3 tensões - 12 terminais
Português



**Etiqueta
SAC STEMAC**



Verificação do sistema de aterramento



Operação em bypass



4.5.3 Etiquetas de identificação para transporte, instalação ou movimentação de equipamento

Verificar no equipamento a presença das etiquetas ver Figuras 1, 2, 3, 4 e 5.

Considerações:

- O equipamento (grupo gerador) não pode ser içado pela alça do gerador ou pelo motor (Figura 1);
- Somente içar o equipamento conforme previsto no Capítulo 4 deste manual;
- Qualquer outra forma de içamento pode danificar o equipamento, bem como trazer risco à segurança.



Figura 1

- Quando da movimentação do equipamento (grupo gerador) observar a ilustração de como proceder (Figura 2).



Figura 2

4.5.4 Etiquetas de identificação de instalação e entrega técnica

- Atentar no equipamento (grupo gerador) o correto aterramento antes de acionar o equipamento (Figura 3);
- O aterramento do equipamento (grupo gerador) deve estar conforme previsto no Capítulo 4 deste manual;
- A não observância do aterramento pode danificar o equipamento, bem como trazer risco à segurança e risco de vida.
- Etiqueta lacre do equipamento (grupo gerador) (Figura 4);
- Somente um técnico da STEMAC, no momento da entrega técnica, poderá romper a mesma.



Figura 3





Figura 4

- Etiqueta de advertência sobre a utilização do anticorrosivo conforme manual do fabricante. No caso de motores Volvo é colada a identificação (Figura 5). Para todos os motores deve ser consultado o manual do fabricante;
- O circuito de comando somente deverá ser interligado pelos técnicos da STEMAC durante entrega técnica, conforme Capítulo 6 deste manual;
- A não observância da entrega técnica por técnicos da STEMAC podem trazer risco de vida assim como a perda da garantia.
- Atentar no equipamento (grupo gerador) a presença da etiqueta ao lado (Figura 6).



Figura 5

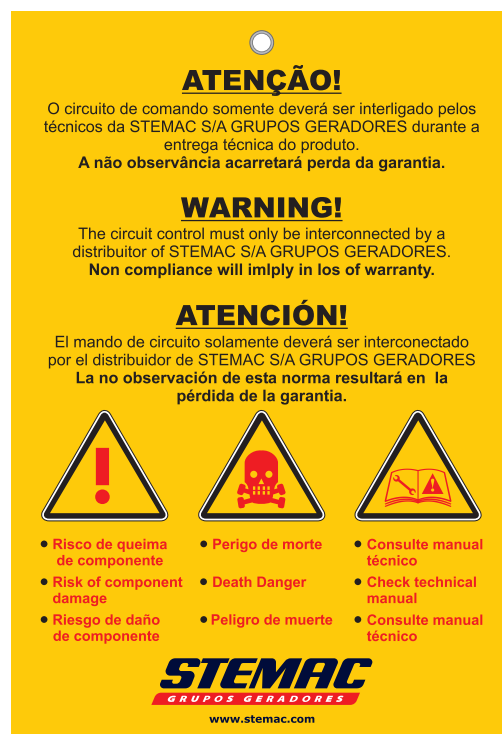


FIGURA 6

4.5.5 Etiquetas de identificação de ligação do gerador e condição de recebimento de motor

- Ligações do gerador conforme tensão do Equipamento (grupo gerador) (Figura 7).
- Atentar no equipamento (grupo gerador) a presença da etiqueta ao lado fixada do motor (Figura 8);
- Em alguns casos, o motor é fornecido SEM o óleo lubrificante, devendo o mesmo ser abastecido quando da instalação/entrega técnica;
- A não observância à presença de óleo lubrificante no motor e, a partida do mesmo nessas condições, pode danificar o motor.



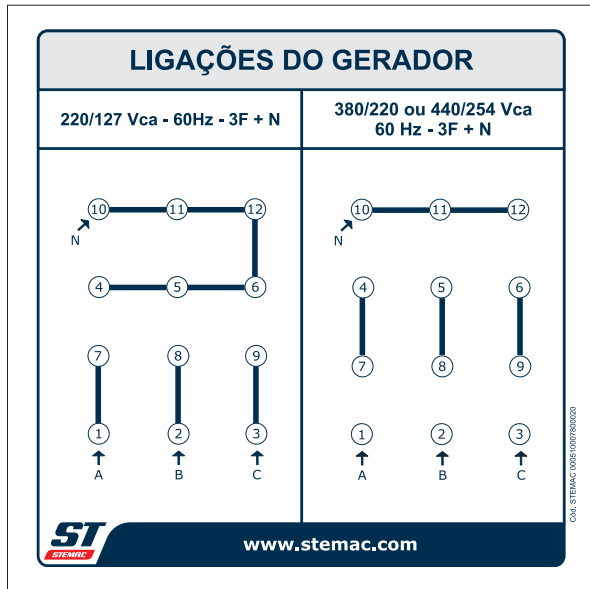


Figura 7

ATENÇÃO

- MOTOR SEM ÓLEO LUBRIFICANTE
- MANTENHA O GMG PROTEGIDO DE INTEMPÉRIES
- NÃO RETIRE OS LACRES
- A ENTREGA TÉCNICA DEVERÁ SER FEITA POR TÉCNICOS DA STEMAC
- NONON NONO

ATENCIÓN

- MOTOR SIN ACEITE LUBRICANTE
- MANTENHA O GMG PROTEGIDO DE INTEMPÉRIES
- NÃO RETIRE OS LACRES
- A ENTREGA TÉCNICA DEVERÁ SER FEITA POR TÉCNICOS DA STEMAC
- NONON NONO

ATTENTION

- ENGINE WITHOUT LUBRICANT OIL
- MANTENHA O GMG PROTEGIDO DE INTEMPÉRIES
- NÃO RETIRE OS LACRES
- A ENTREGA TÉCNICA DEVERÁ SER FEITA POR TÉCNICOS DA STEMAC
- NONON NONO

- CONSULTE MANUAL TÉCNICO
- CONSULTE EL MANUAL TECNICO
- CHECK THE O&M MANUAL

www.stemac.com

Cod. STEMAC 050.006.0159 Rev.02

Figura 8



5. Instalação

Esse capítulo detalha as condições mínimas a serem observadas e seguidas conforme aplicabilidade, pelos Instaladores (contratados pela STEMAC) ou pelos próprios Clientes, quando da instalação do Grupo ou Grupos Geradores. Em caso de dúvidas por parte do Instalador, a STEMAC deve sempre ser contatada e questionada de forma a esclarecer e dar a devida orientação técnica. O não seguimento das condições mínimas descritas a seguir, conforme sua aplicabilidade, pode comprometer o funcionamento dos equipamentos. A STEMAC não se responsabiliza pelo não cumprimento e possível mal funcionamento do Grupo ou Grupos Geradores, uma vez caracterizado o problema de instalação por parte de Instaladores (contratados pelo cliente). Para instalação e funcionamento adequado deste equipamento, a STEMAC recomenda a contratação de empresa especializada (civil, elétrica e mecânica).

5.1 Construção Civil (adequações civis conforme layout)

O layout de sala é apenas orientativo, servindo para referenciar as principais exigências da instalação (posições aproximadas dos equipamentos e acessórios, dimensões e resistência do piso estruturado, posições e dimensões das aberturas para atenuadores para aspiração e exaustão, trajetos e bitolas a serem seguidos pelas tubulações de óleo diesel e escapamento, além do encaminhamento dos cabos elétricos de força e comando).

Poderão ocorrer divergências entre as indicações do layout e as executadas na obra, desde que mantidas as premissas básicas da instalação. Caso exista a necessidade de alterações significativas no layout fornecido, a STEMAC deve ser consultada antes da instalação do equipamento. O projeto executivo deverá, caso necessário, ser

realizado pelo cliente em função das particularidades de cada obra.

5.1.1 Estudo do solo

Obrigatório, a cargo do cliente. Este serviço deve ser efetuado por uma empresa de engenharia civil.

5.1.2 Fundações

Obrigatório. Pode ser fundação por estaca, por vigas normais, "radier". Este projeto é a cargo do cliente e deve ser executado por uma empresa de engenharia civil.

5.1.3 Piso estruturado

Obrigatório. Em concreto, do tipo armado, não armado, etc., deve ser definido pela empresa contratada para execução da civil considerando as características apontadas no layout STEMAC. A responsabilidade na execução é do cliente, e este deve contratar empresa de engenharia civil.

O piso estruturado servirá para o assentamento do grupo gerador em sala ou em container, para receber os esforços estáticos e dinâmicos deste.

A área estruturada (reforçada) deverá ser maior que a base metálica do grupo gerador em todas suas extremidades em no mínimo 150mm.

Atentar na execução do piso para a existência ou não de canaletas para acondicionamento das interligações elétricas, ou tubulações de diesel.

Em instalações de Grupos Geradores sobre lajes pré-existentes, deverá ser adotado pelo cliente o mesmo critério, avaliando com empresa de engenharia civil se a estrutura da laje comporta os esforços estáticos e dinâmicos gerados pelo equipamento. Avaliar a necessidade de reforços estruturais e ainda a instalação de amortecedores de vibração, ou niveladores.



5.1.4 Nivelamento do piso

O piso a ser instalado o equipamento deve estar perfeitamente nivelado, instalações que não cumpram com o nivelamento podem causar danos ao equipamento. Além do piso NIVELADO, o mesmo deverá estar LISO e PLANO, a fim de poder receber os esforços da base ou dos amortecedores / niveladores.

5.1.5 Bacia de contenção para tanque principal e recipientes diários do consumo de combustível

Obrigatório. As dimensões das bacias dependem da capacidade do tanque e porte do grupo gerador. Devem ser impermeabilizadas e com dreno. A responsabilidade na execução é do cliente, que deve contratar empresa de engenharia civil.

O volume interno da bacia de contenção deve ser superior a 110% da soma dos volumes de todos os líquidos contidos no GMG (óleo diesel, óleo lubrificante e água de arrefecimento).

A bacia de contenção, se instalada ao tempo, deverá ser dotada de um dreno na sua parte inferior (normalmente fechado), e este deverá ser tubulado à uma Caixa Separadora de Água e Óleo – C.S.A.O. de responsabilidade do cliente.

Essas bacias deverão ter suas paredes internas impermeabilizadas através de pintura com tinta base EPÓXI AMIDA. Segue uma sugestão de procedimento:

- 01 demão 50 μ de SHERILE CLEAR SUMARÉ, ou similar.
- 03 demãos 120 μ de PHENICOM ACABAMENTO SUMARÉ, ou similar.

5.1.6 Lajes de cobertura:

Obrigatório para sala atenuada. O concreto pode ser do tipo armado, ou pré-moldado, ambos deverão ser devidamente calculados para receber a sustentação das tubulações de escape e silenciosos. A responsabilidade na execução é do cliente, que deve contratar empresa

de engenharia civil.

5.1.7 Abertura de aspiração e exaustão:

Obrigatório. O projeto, porém, depende de cada fornecimento em particular. Seguir orientações do layout de instalação. A responsabilidade na execução é do cliente, que deve contratar empresa de engenharia civil.

Em salas atenuadas as aberturas destinadas à instalação dos atenuadores de ruídos deverão ser executadas previamente, com dimensões de no mínimo 50 mm maiores que as dimensões dos atenuadores, conforme indicado no layout. O acabamento junto destas aberturas deverá ser executado após a instalação dos atenuadores, não podendo haver folgas entre a alvenaria e os caixilhos metálicos dos mesmos.

5.1.8 Caixa coletora para respiro do cárter:

Obrigatória. A responsabilidade de execução é do cliente que deve contratar empresa de engenharia civil para executar caixa de alvenaria impermeabilizada, com tampa vedada para evitar a entrada de água, e com respiro sobre a tampa (curva 180°). Deverão ser instaladas tubulações metálicas ou em PVC rígido para alta temperatura com bitola imediatamente superior a saída do motor para interligação do cárter do motor até a caixa coletora.

5.1.9 Recomendações gerais antes do início da instalação:

- O instalador deve inspecionar cuidadosamente o local de montagem, tendo em mãos o layout de instalação;
- Verificar se os equipamentos e acessórios fornecidos estão de acordo com o indicado em projeto;
- Não é permitido que o instalador ou operador use qualquer tipo de ferramenta improvisada ou inadequada ao serviço;
- Todos os equipamentos devem permanecer cobertos e protegidos durante a execução dos serviços.



5.2 Instalação Elétrica

5.2.1 Acondicionamentos:

- Leitões
- Eletrocalhas - lisas ou perfuradas
- Canaletas no piso - com tampas
- Eletrodutos - PVC ou metálicos

5.2.2 Interligação de força - baixa tensão:

- Conforme norma NBR 5410.
- Deverá ser utilizado conector do tipo YA (barril longo, duplo aperto). Não é permitido uso de terminais tipo sapata.
- O terminal de neutro de cada gerador deve ser interligado à barra de neutro da USCA ou do QTA, através de cabos de força para neutros dimensionados conforme projeto específico.

5.2.3 Interligações de comando:

Para interligação dos cabos de comando, seguir projetos elétricos - Diagramas de Interligação de Comando.

- Acondicionamentos: eletroduto metálico flexível SEALTUBO.
- Cabo reserva.
- Cabos de comunicação: conforme projeto específico (CAN, Fibra ótica, RS 232, RS 485, Ethernet).



NOTA

O cliente não deve conectar cabos de comando, apenas acondicioná-los, identificá-los com anilhas.

5.2.4 Elétrica - Aterramento:

- Deve ser instalado uma barra de cobre (barra de equipotencialização) na sala (s) do(s) Grupo (s) Gerador (s), o mais próximo possível, que será conectada ao ponto de aterramento

disponibilizado pelo cliente.

- Todas as interligações do sistema de aterramento devem ser executadas utilizando-se cabos de cobre nu ou isolados (na cor verde), conforme especificado em tabela.
- Leitões, eletrocalhas, cabos blindados e eletrodutos metálicos devem ter suas blindagens aterradas nas suas extremidades.
- O sealtubo, utilizado para acondicionar os cabos de comando, deve ser aterrado em uma de suas extremidades.
- A impedância máxima admitida para a malha de aterramento do cliente é de 10 ohms.
- A proteção contra descargas atmosféricas-SPDA: é a cargo do cliente. Este serviço deve ser efetuado por uma empresa especializada.
- As carcaças dos painéis elétricos, tanques metálicos, ventiladores e eletrobombas, serão aterrados na barra de terra da sala.
- Estarão conectados ao grupo gerador o escapamento, o caixilho metálico dos atenuadores e a base metálica do grupo gerador, tendo um único ponto de saída localizado na carcaça do gerador, que deverá ser interligado à barra de terra dentro da sala.
- A barra de terra da USCA deverá ser interligada à barra de terra da sala através de condutor específico para o terra, não podendo ser utilizado o condutor de neutro.

5.2.5. Interligação de Força - Média Tensão

- Conforme norma NBR-14039.
- O terminal de neutro de cada gerador deve ser conectado a barra de terra (equipotencialização, item 5.2.4 - Aterramento) através de cabos de força para neutro conforme projeto específico.

5.3 Mecânica-sistema de escapamento

Isolamento Térmico: Recomenda-se a aplicação de isolamento térmico sobre a tubulação de escapamento e silencioso, em manta de lã



de vidro ou lã de rocha, amarrada com arame, recoberta com proteção mecânica em chapa de alumínio ou manta Thermovid costurada, para redução dos riscos de queimadura aos operadores e redução da dissipação de calor para a sala.

Pode ainda ser utilizado revestimento da tubulação tipo “jaqueta”, devidamente dimensionado e fabricado para esta aplicação.

Passagem da Tubulação pela Alvenaria: passagem das tubulações de escapamento por paredes deve permitir sua dilatação sem prejudicar o isolamento térmico e acústico da sala. Recomenda-se observar as instruções da Stemac para cada caso.

Passagens de tubulações pelo teto, Lajes ou telhados, devem possuir acabamento para evitar a entrada de água de chuva.

Silenciosos: os silenciosos utilizam fibra mineral como material fonoabsorvente. É proibido



NOTA

Em tubulações de escapamento com comprimento acima do padrão é indicado o emprego de juntas de expansão a cada 15m de trecho reto.

qualquer tipo de solda em seus corpos. Monte o silencioso preferencialmente na posição horizontal, observando-se seu correto nivelamento, na posição indicada no layout. Para perfeita vedação entre flanges de acoplamento e tubulação, utilize juntas de amianto grafitadas.

Catalisador: para manter sua eficiência, deve ser montado o mais próximo possível do motor e antes do silencioso. Instalados preferencialmente na posição horizontal, observando-se o nivelamento correto dos mesmos e para a perfeita vedação entre os flanges de acoplamento utilize juntas de amianto grafitadas. Por questões de irradiação de calor, o catalisador pode necessitar de isolamento térmico.

Segmento elástico: utilizado para evitar a propagação das vibrações geradas pelo funcionamento do grupo gerador, o mesmo é acopla-

do diretamente no coletor de gases do motor. O segmento elástico deve ser em inox, e tem como finalidade compensar os movimentos relativos (vibrações) e expansões térmicas, o segmento elástico é montado tracionado 15mm em relação a sua posição de descanso.

- Flanges: os flanges deverão ser adquiridos e/ou confeccionados com base nos silenciosos, segmento elásticos, e de acordo com as



NOTA

O segmento elástico deve ser montado sobre o coletor do motor tracionado 15mm em relação a sua posição de descanso.

características da tubulação adquirida.

- Isolamento térmico de tubulações: conforme projeto Stemac ou responsabilidade do cliente.
- Sustentações: conforme desenhos de instalação com base no projeto de instalação ou responsabilidade do cliente.
- Pintura. Tratamento de superfície (Conforme TPM011-15):
 - ✓ Tubulações de escape e acessórios de escape (sujeitos a alta temperatura) fabricadas em aço carbono.
 - ✓ Tratamento de superfície:
 - Lavagem e desengraxe com lixamento de eventuais pontos de corrosão.
 - Limpeza final com panos secos e sopro de ar comprimido
 - Uma demão de 25 a 30 μ m de tinta para alta temperatura à base de silicone. (KEM HTS 600 – Preto fosco – Sumaré. Diluição: 10-15% Diluente: 198905 Sumaré).
- Passagem da tubulação pela alvenaria: Conforme projeto STEMAC ou responsabilidade do cliente.
- Ponteiras: utilizar tampas oscilantes para terminações na vertical e corte chanfrado 45° na horizontal.



5.4 Mecânica - Sistema Diesel:

Acondicionamento: pode ser acondicionado em canaletas ou fixados sobre o piso. Contemplar sempre proteção mecânica dos tubos ou mangueira.

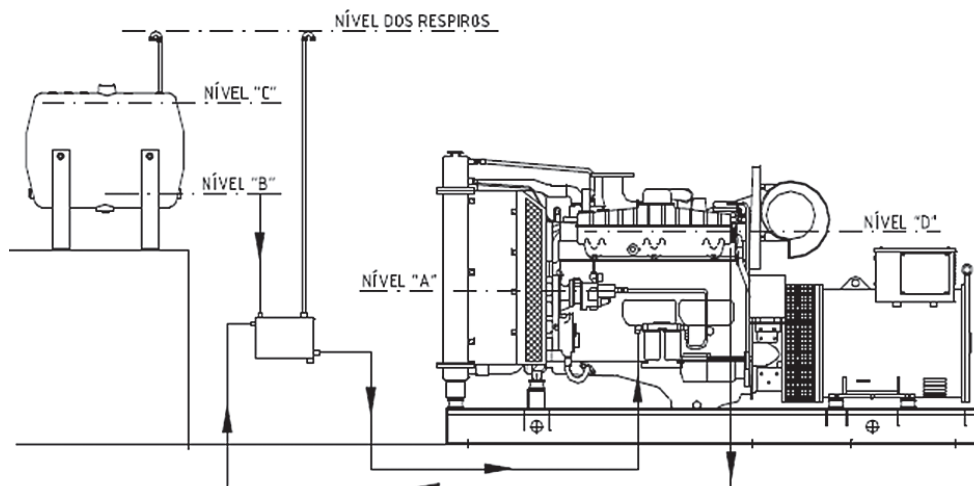
Tipos de interligação utilizados no sistema diesel:

- ✓ Tubos de aço ASTM A53, A160 SCH 40, ou tubo de aço preto DIN2440
- ✓ Aplicação: Para todos os GMG's em paralelos ou GMG's singelos acima de 500kVA.
- ✓ Conexões roscáveis do mesmo material, ou união por solda
- ✓ Mangueiras translúcidas
- ✓ Mangotes Aeroquip e Goodyear GOG
- Mangueira Translúcida.
 - ✓ Aplicação: Para todos os GMG's singelos até 500kVA (inclusive).
- Mangotes Aeroquip e Goodyear GOG.
 - ✓ Aplicação: Para interligação entre a Tubulação metálica e o motor, de modo à evitar vibrações.
- Pintura:
 - ✓ Preparação da superfície: limpeza mecânica manual.

Tabelas de Alturas Manométricas tanques Diários

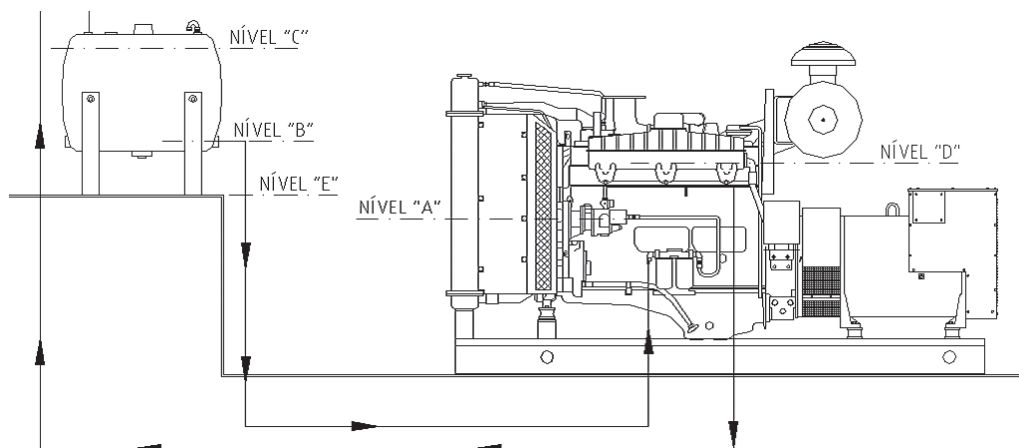
Motor	Altura
MWM	Preferencialmente com nível "A" entre níveis "B" e "C"
Cummins linhas N, Q, V e K	Com nível "C" até 1,5m acima do nível "A". Com nível "B" acima do nível "A".
Mercedes	Com nível "C" até 1,5m acima do nível "A". Com nível "B" até 1m abaixo do nível "A".
Mitsubishi	Com nível "C" até 2m acima do nível "A". Com o nível "B" até 1m abaixo do nível "A".
Perkins	Com nível "C" até 4m acima do nível "A". Com o nível "B" até 1,8m abaixo do nível "A".
Volvo	Com nível "C" até 1,5m acima do nível "A". Com o nível "B" até 1,5m abaixo do nível "A".
MTU	Com nível "C" até 1m acima do nível "A". Com o nível "B" até 1m abaixo do nível "A".
Scania	Com nível "C" até 2m acima do nível "A". Com o nível "B" até 1m abaixo do nível "A".

Para instalações em que o tanque diário será instalado em altura superior aos limites acima expostos, deverá ser utilizado um "float tank" para a redução das pressões de linha, conforme figura abaixo.



Em instalações de GMG's em paralelo e/ou STR faz se necessário à elevação da base do tanque diário de forma a manter a bomba injetora afogada.





Nas instalações em que um tanque principal alimenta por gravidade um tanque diário ou float tank, os respiros destes devem ser prolongados até uma altura no mínimo igual à do respiro do primeiro, de modo a evitarem-se transbordamentos em caso de falha das torneiras bóias

NOTA

É terminantemente proibido o uso de tubulação galvanizada, esta reage com o diesel e impregnando os filtros do motor.

- ✓ Sistema de pintura: aplicar uma demão única de SUMASTIC 90 Alumínio - SUMARÉ ou similar, com espessura de película seca de 100 μ . As ferragens deverão receber o mesmo tratamento.

- Nível entre motor e tanque:
 - ✓ Recipientes Diário de Consumo.

Os reservatórios que alimentam diretamente o grupo gerador devem obedecer as alturas recomendadas abaixo:

- Nível A** = nível da bomba injetora
- Nível B** = nível de saída de alimentação do recipiente diário de consumo
- Nível C** = nível máximo de óleo do recipiente diário de consumo
- Nível D** = nível dos cabeçotes do motor

- Tipos de tanque (principal):

- ✓ **Subterrâneo:** devem ser instalados atendendo a norma NBR 13781 com todos os

periféricos ecológicos da mesma maneira que a forma construtiva deve atender a norma NBR 13785 (para tanque jaquetado). Atenção para legislação local.

- ✓ **Aéreo:** devem ser instalados com base na norma NBR 17505-1. O tanque aéreo principal pode alimentar os tanques diários por gravidade ou por meio de eletrobomba. A forma construtiva destes tanques deve atender a norma NBR 17505-2
- ✓ De modo a atender as normas de segurança prescritas na norma NBR 17505-1, os tanques de combustível devem ser circundados por uma mureta de contenção impermeabilizada de altura tal, que permita armazenar todo volume destes em caso de vazamento. Para tanto, a execução desta deverá considerar o volume do tanque e o volume ocupado pelos apoios (pés) dos tanques.

Tipos de Recipientes Diário de Consumo:

- ✓ **Aéreos;** auto - portantes ou skid na base dos Grupos Geradores
- Tipos de abastecimento (entre tanque principal e tanques diários):



- ✓ **Abastecimento por Eletrobomba:** no abastecimento por eletrobomba, sempre tenha instalado nos Recipientes Diários de Consumo, chave bóia NA/NB para comandar o acionamento e a parada de eletrobomba e mais válvula solenóide na linha de abastecimento (entrada de alimentação externa recipiente diário de consumo). Instale a eletrobomba o mais próximo possível do tanque principal, diminuindo ao máximo a distância de sucção.

Em instalações que se empregam eletrobombas MINOR modelo BJE ou fabricante de Bombas modelo FBE, as mesmas deverão ser locadas o mais próximo dos tanques principais, de modo a permitir um preferencial trabalho de recalque e não de sucção. Em instalações alimentadas por eletrobomba deve possuir a presença de uma tubulação de retorno de diesel do tanque diário para o tanque principal (ladrão), prevenindo assim um transbordamento por eventual falha da chave-bóia. Deve ser prevista nos tanques aéreos a instalação de visores de nível, para permitir inspeções visuais. Esta tubulação deverá ter no mínimo duas vezes o diâmetro da tubulação de alimentação dos tanques diários

O sistema de alimentação deve ter a tubulação dimensionada respeitando a vazão e a perda de carga admitida pela eletrobomba dimensionada.

- ✓ **Abastecimento por gravidade:** neste abastecimento o tanque principal deverá ser elevado de modo a manter o abastecimento natural por gravidade. É fundamental elevar o suspiro dos tanques diários ao mesmo nível da altura máxima do suspiro do tanque principal assim prevenindo um transbordamento por eventual falha da torneira-bóia. É importante salientar que a torneira bóia admite no máximo 8 mCA. Para recipientes diário de consumo Skid na base dos Grupos Geradores obrigatoriamente deve ser instalada chave bóia ou sensor de nível e válvula solenóide.

- **Respiro de cárter:** executar seu prolongamento para área externa a sala dos grupos geradores. Deve ser construída caixa coletora de óleo em sua extremidade.
- **Filtros diesel:** recomendamos a utilização de filtro separador de água e óleo na linha de alimentação diesel devido a desconhecemos a as características do diesel adquirido para consumo dos grupos geradores de modo a aumentar a vida útil dos filtros dos motores.

5.5 Diversos

- Amortecimento de vibrações:
 - ✓ **Calços niveladores - Vibrastop ou similar:** é indicado para pequenos ajustes no nivelamento do grupo gerador. Apresenta baixa absorção de vibrações para a estrutura.
 - ✓ **Amortecedores de vibração - Gerb, Vibrashoc ou similar:** indicados para aplicações em grupos geradores que estejam instalados sobre lajes e/ou salas geminadas. Apresenta um bom índice isolamento de vibrações
- Atenuação de ruídos: o sistema de tratamento acústico destina-se a redução dos níveis de ruído, gerados pelo equipamento, para atender as necessidades de conforto acústico especificadas pelo cliente.



6. Entrega Técnica

6.1 O que é Entrega Técnica

O conceito “Entrega Técnica” do grupo gerador, corresponde à primeira partida do equipamento realizada nas dependências do cliente, onde também é demonstrada a sua operação.

Antes disso, são feitos todos os testes necessários de instalação e funcionamento do equipamento. Este trabalho é realizado exclusivamente por técnicos STEMAC.

6.2 Procedimentos na Entrega Técnica

- 1- Verificação geral da instalação, interligações, etc.
- 2- Condições do motor: níveis de óleo e água, sistema de alimentação de combustível, etc.
- 3- Execução dos testes de funcionamento, nas condições de tensão e carga previstas no projeto.
- 4- Startup: o técnico irá colocar o Grupo Gerador em funcionamento.

6.3 Como solicitar Entrega Técnica

Para agendar a Entrega Técnica de seu equipamento ligue para o Canal Nacional de Serviços e Peças - 0300 789 3800 e solicite seu agendamento, observando se a instalação é STEMAC ou de terceiros.

6.4 Instalação STEMAC:

O agendamento é feito pelo Departamento ADCON/INSTALAÇÕES após ser acionado pelo cliente. A Adcon/Instalações aciona uma empresa instaladora credenciada STEMAC para a ins-

talação e monitora constantemente o andamento do serviço.

Ao final, a instaladora preenche o check-list de instalação (ou check-list para Entrega Técnica) e o encaminha a filial STEMAC da região.

6.5 Instalação não STEMAC:

- a) O cliente contrata a empresa de sua preferência para efetuar a instalação.
- b) Após a instalação, contatar o Canal Nacional de Serviços e Peças - 0300 789.3800, para solicitar entrega técnica e documentação necessária para encaminhar o agendamento.

NOTA

- A STEMAC reserva-se o prazo de 15 dias, a contar do envio da documentação (check-list) de instalação, para a realização entrega técnica do equipamento.
- Se no momento da entrega técnica forem identificadas não conformidades nas instalações, condições de tensão e carga, que impessam a efetivação do serviço, a STEMAC reserva-se o direito de repassar custos decorrentes de uma nova visita técnica.
- Fica sujeito a perda da garantia o equipamento que for acionado pela primeira vez (start-up) por pessoa não autorizada STEMAC, e que apresente falhas futuras decorrentes de tal atitude.
- O cumprimento da data acordada para finalização da entrega técnica (instalação e funcionamento do equipamento), está condicionado a adequação e ajustes de outros equipamentos parametrizados quando estes forem de responsabilidade de terceiros.



**ATENÇÃO**

Antes de iniciar a Entrega Técnica, o entregador deve definir, juntamente com o cliente:

- 1- Os participantes da Entrega Técnica;
- 2- O representante titular do cliente para quaisquer contatos da STEMAC sobre o(s) Grupo(s) Gerador(es) em questão.

Obs. 1: As informações “1 e 2” devem constar no check-list de Entrega Técnica. No caso do representante, devem constar também as respectivas formas de contato: fone e email.

Obs. 2: O check-list para Entrega Técnica só tem valor se for devidamente assinado pelo “representante titular do cliente” e pelo técnico que efetuou a instalação.

Obs. 3: Após 6 meses de armazenamento do equipamento inativo, a STEMAC deverá ser consultada para realização do procedimento de conservação. Os custos decorrentes deste, são de responsabilidade do cliente.

Obs. 4: No ato da Entrega Técnica ou ativação é necessário disponibilidade de carga mínima de 50%. Caso ocorra a E.T ou ativação sem atender este critério, os atendimentos para novas parametrizações não estarão cobertos pelo termo de garantia.



7. Operação

7.1 Regimes de Operação

Os grupos geradores são projetados para três regimes de potência a serem considerados de acordo com a forma de utilização, especificado no momento da venda a partir da necessidade identificada

Emergência (Stand-by Power):

Grupos geradores classificados neste regime são disponíveis para suprimento de energia durante a falta da rede comercial. Não admite sobrecarga. Este regime deve ser utilizado em locais supridos por rede comercial confiável. Grupos geradores classificados neste regime são dimensionados para operar com cargas variáveis por um período de até 300 horas/ano, respeitando-se os intervalos de manutenção determinados pela STEMAC S/A GRUPOS GERADORES.

Horário de Ponta (Prime Power):

Grupos geradores classificados neste regime são disponíveis para acionamento das cargas variáveis por um período de até 1000 horas/ano, respeitando-se os intervalos de manutenção determinados pela STEMAC S/A GRUPOS GERADORES. São indicados para uso em situações programadas, tais como horários de ponta. Neste regime não há necessidade de reserva de potência ou potência de sobrecarga.

Contínuo (Base-Power):

Grupos geradores classificados neste regime são disponíveis para acionamento de cargas constantes por um período ilimitado de tempo, respeitando-se os intervalos de manutenção determinados pela STEMAC S/A GRUPOS GERADORES. Neste

regime não há necessidade de reserva de potência ou potência de sobrecarga.

Obs: Estes regimes de potências são baseados nas normas ISO 8528.

Caso o regime de operação utilizado pelo Cliente seja alterado e diferente do regime definido e especificado, na proposta de venda, o mesmo passa a ser item de restrição da garantia conforme previsto no capítulo 8 - Item 8.1 - Termo de Garantia STEMAC (Limitações a Garantia). Exceções poderão ocorrer desde de que acordadas e oficializadas pela STEMAC S/A GRUPOS GERADORES.

7.2 Acionamento e Operação

Todas as verificações e testes iniciais de operação devem obrigatoriamente ser executados por Técnicos da STEMAC no momento da Entrega Técnica, conforme descrito no capítulo 7 deste manual.

No momento da Entrega Técnica serão repassadas todas as informações quanto à forma de operação e cuidados com o Grupo Gerador, inclusive sendo comentados os modos de operação (Manual ou Automático), dependendo do pedido comercial, através dos manuais específicos dos respectivos fornecedores.

Excepcionalmente caso a Entrega Técnica não seja efetuada por Técnico da STEMAC, o acionamento e operação somente deve ocorrer por pessoal técnico capacitado para tal, com suporte técnico da STEMAC. Seja através dos manuais de operação específicos do Grupo Gerador ou pelo atendimento técnico através do Canal Nacional de Serviços e Peças - 0300 789 3800. Ao entrar em contato conosco, tenha em mãos o nº do motor e/ou gerador e garanta um atendimento ágil.



7.3 Modos de Operação

Os Grupos Geradores, dependendo do modelo adquirido, poderão ser do tipo Manual ou Automático.

No caso de Controle Manual, toda operação é iniciada, controlada e encerrada manualmente através de operador capacitado.

No caso de Controle Automático, toda operação pode ser iniciada, controlada e encerrada automaticamente através de Controladores Lógicos Programáveis específicos da STEMAC. Nos casos de partidas automáticas (Horário de Ponta, Falta de Luz, Operações de Grupos em Paralelo, etc.) este tipo de controle é o utilizado. Existem uma série de proteções que automaticamente podem agir e encerrar a operação de modo a proteger o Grupo Gerador contra danos operacionais que poderiam trazer danos graves ao equipamento e/ou instalações. Em caso de necessidade, todos os Controladores permitem fazer o controle e operação no modo Manual, através de operador capacitado.

7.4 Riscos na Operação

Os grupos geradores não devem operar com carga inferior a 30% de carga de sua capacidade nominal, sob risco de trazer danos ao motor ou reduzir sua vida útil.

Os motores diesel e gás são projetados para operar com cargas próximas da nominal.

Muito embora dar-se ênfase de que cargas inferiores a 30% são proibitivas, cargas entre 30% e 50% ainda apresentam risco de redução da vida útil do motor. Sendo que cargas acima de 50% e até o limite nominal são as indicadas na operação do grupo gerador.



8. Manutenção

O objetivo da manutenção é garantir operacionalidade do grupo gerador em condições apropriadas, proporcionando melhor desempenho e vida útil ao equipamento, além de evitar ocorrência de falhas.

Além das recomendações e orientações da STEMAC, o Cliente deve cumprir com o descrito nos Manuais específicos de manutenção dos fabricantes dos motores e geradores. Em caso de dúvidas referentes a manutenção, contate o Canal Nacional de Serviços e Peças pelo número 0300 789 3800.

Para efeito de procedimento classificamos a manutenção em dois tipos distintos, manutenção preventiva e manutenção corretiva.

8.1 Manutenção Preventiva

Consiste na verificação periódica das condições do equipamento, seguindo recomendações do fabricante, de forma a manter uma boa condição de funcionamento.

As informações específicas de manutenção de cada equipamento estão contidas nos respectivos manuais dos fabricantes do motor e gerador.

8.1.1. Recomendações

Limpeza

A STEMAC adotou em seus equipamentos as melhores soluções tecnológicas para proteger com eficácia a carenagem contra corrosão e abrasão.

A manutenção da carenagem consiste na lavagem com água, esponja e sabão neutro, cuja frequência dependerá das condições do ambien-

te em que o equipamento estiver instalado (não utilizar solventes, produtos que reajam com a pintura e lava jato).

Estes cuidados evitarão que agentes corrosivos interfiram na vida útil da pintura original do container.

As principais causas de fenômenos de corrosão são:

- Poluição atmosférica;
- Salinidade e umidade (regiões litorâneas ou com clima quente e úmido);
- Variações climáticas das estações;
- Abrasivos: Vento, pó, areia, lama, cascalhos, resina de árvores, sujeira de pássaros, resíduos industriais.

Em caso de abrasões ou riscos profundos, aconselha-se realizar os devidos retoques, para evitar formações de ferrugem.

Também, em seu interior, os geradores devem ser mantidos limpos, isentos de poeira, detritos e óleos.



NOTA

Tomar cuidado para que durante o procedimento de limpeza a água não atinja o interior do equipamento.

Sistema de Exaustão

Nos casos dos escapamentos de Grupos Geradores em Contêineres, a tampa oscilante deve permanecer com livre movimento, isento de oxidações e lubrificada no seu eixo de movimento. Quando não em operação, a tampa oscilante deve vedar a extremidade do tubo de escape.



mento que fica na área externa do Contêiner. A não observância dessa questão pode trazer danos irreparáveis ao motor caso haja entrada de água pelo escape (calço hidráulico no motor).

A não observância das questões de limpeza podem com o tempo trazer danos ao Grupo Gerador que podem restringir à Garantia da STEMAC, conforme descrito no capítulo 8 deste manual

Motor Diesel

Conforme orientação nos manuais específicos dos fabricantes dos motores.

Peças e Consumíveis

Utilizar somente peças originais de reposição e consumíveis de acordo com os manuais dos fabricante.

Consiste na eliminação de quaisquer tipos de falhas relacionadas aos equipamentos. Para proceder a uma boa manutenção corretiva é recomendado que sua execução seja realizada por técnicos capacitados pela STEMAC S/A GRUPOS GERADORES. Em caso de dúvidas, entrar em contato o Canal Nacional de Serviços e Peças - 0300 789 3800 (sempre de posse do número de série motor ou gerador).

8.2.1 Diagnóstico de falhas

É chamado diagnóstico de falhas o estudo organizado do problema e o método planejado de investigação e correção da falha. Na tabela 02 informamos alguns dos problemas mais comuns que o operador poderá ter que enfrentar durante a vida útil de um motor e possíveis verificações e ações corretivas.

8.2 Manutenção Corretiva

DEFEITO	CAUSAS PROVÁVEIS
Baixa rotação de partida	01-02-03-04
Motor não pega	01-05-06-07-08-09-10-12-13-14-18-20-49
Motor custa a pegar	05-07-08-09-10-11-12-13-14-18-19-20-22-49
Falta de potência	08-09-10-11-12-13-14-18-19-20-21-22-23-24-25-44-46-47
Motor falhando	08-09-10-12-13-14-18-23-24-26-27
Consumo excessivo de combustível	11-13-14-18-20-21-22-23-25-26-47
Fumaça preta	11-13-14-18-20-22-23-25-26-44
Fumaça branco-azulada	04-18-23-25-45
Baixa pressão de óleo	04-28-29-30-31-42
Motor com batidas internas	14-18-20-24-26-43
Funcionamento irregular	07-08-09-10-11-12-13-14-19-21-24-26-27-43
Vibração excessiva	13-14-21-23-24-27-32-33
Alta pressão de óleo	04-29
Superaquecimento	11-13-14-18-22-23-34-35-36-37-38-41
Excessiva pressão no cárter com possíveis vazamentos de óleo	23-39
Baixa compressão	11-23-26-43
Motor pega e morre	10-11-12
Motor dispara	07-13
Alto consumo de óleo lubrificante	04-16-17-39-48
Água misturada ao óleo lubrificante	15-23-42



	DEFEITO	AÇÃO
1	Bateria com carga baixa	Carregar ou substituir
2	Mal contato nas conexões elétricas	Limpar e reapertar
3	Motor de partida defeituoso	Consertar
4	Óleo lubrificante de viscosidade inadequada	Substituir o óleo
5	Baixa rotação de partida	Verificar conexões, baterias e motor de partida
6	Falta de combustível	Abastecer o tanque
7	Estrangulador de combustível defeituoso	Verificar a liberdade de cabos/solenóide cremalheira da bomba injetora
8	Tubo de alimentação de combustível obstruído	Limpar o sistema
9	Bomba alimentadora de combustível defeituosa	Reparar a bomba
10	Filtros de combustível obstruídos	Limpar ou substituí-los
11	Restrição no sistema de admissão de ar	Desobstruir o sistema ou limpar o elemento do filtro de ar
12	Ar no sistema de combustível	Sangrar o sistema
13	Bomba injetora defeituosa	Enviar a um posto de serviço
14	Injetores defeituosos ou incorretos	Verificar o tipo de injetores ou corrigi-los
15	Vazamento pelos anéis de vedação das camisas do cilindro	Substituir
16	Assentamento irregular dos anéis	Substituir
17	Nível elevado de óleo no cárter	Drenar
18	Bomba injetora fora do ponto	Corrigir o ponto de injeção da bomba
19	Respiro do tanque de combustível obstruído	Limpar ou substituir
20	Combustível inadequado	Substituir
21	Acelerador preso ou com movimento limitado	Liberar ou regular as ligações do acelerador
22	Escapamento obstruído	Limpar canos, silencioso, etc.
23	Vazamento na junta do cabeçote	Substituir a junta e verificar as causas do vazamento
24	Superaquecimento	Verificar sistema de arrefecimento, ponto do motor e condições de operação e instalação
25	Motor demasiadamente frio	Verificar válvula termostática
26	Folga das válvulas incorreta	Regular folga de válvulas
27	Tubos de alta pressão incorretos	Substituir
28	Nível baixo de óleo no cárter	Completar
29	Instrumento indicador de pressão (manômetro) deficiente	Substituir
30	Bomba de óleo lubrificante com desgaste interno	Substituir ou recondicionar.
31	Filtro de óleo lubrificante entupido	Substituir elemento
32	Ventilador danificado	Substituir
33	Coxins de suportes do motor defeituoso	Substituir/corrigir montagem
34	Válvula termostática defeituosa	Substituir
35	Restrição nas galerias de água/camisas de cilindro com crostas	Limpar o sistema
36	Correias do ventilador frouxas	Tensionar
37	Radiador entupido externa ou internamente	Limpar



	DEFEITO	AÇÃO
38	Bomba de água defeituosa	Reparar ou substituir
39	Tubo de respiro do cárter entupido	Limpar
40	Vazamento no intercambiador de óleo lubrificante	Corrigir
41	Falta de água no sistema de arrefecimento	Completar nível
42	Peneira do tubo de sucção da bomba de óleo entupida	Limpar
43	Mola da válvula quebrada	Substituir
44	Turboalimentador danificado ou necessitando limpeza	Reparar ou limpar
45	Vazamento pelos retentores de óleo do turboalimentador	Substituir retentores
46	Coletor de escape ligado ao turboalimentador, vazando pela junta	Substituir juntas
47	Pressão de sobrealimentação de ar baixa	Verificar turboalimentador/corrigir vazamentos
48	Vazamentos externos (juntas, retentores, etc.)	Corrigir
49	Comando resseta na partida	Verificar baterias de partida e bateria do comando substituir

8.3 Frequência de Manutenção

8.3.1 Manutenção semanal

- Inspeção visual, principalmente no que diz respeito aos contatos dos relés;
- Examinar as condições das baterias de partida dos GMG's, verificando o nível do eletrólito, o aperto dos terminais de conexão dos cabos e a tensão por elemento, com o retificador desligado;
- Examinar as condições de funcionamento do retificador;
- Verificação de todas as sinalizações e alarme sonoro;
- Examinar as condições de funcionamento do sistema de pré-aquecimento, observando a temperatura, com o motor parado;
- Verificação de funcionamento das chaves seletoras, checando a área de contato das mesmas.

8.3.2 Manutenção mensal

- Verificação de componentes;
- Inspeção visual, principalmente no que diz

respeito aos contatos dos relés;

- Examinar possíveis chamuscamentos nos contatos auxiliares dos relés, assim como dos disjuntores do circuito de força, trocando-os quando a superfície de contato não apresentar mais condições de trabalho;
- Examinar os conectores de interligação interna e externa, observando qualquer mal contato que por ventura possa surgir;
- Retirar a poeira acumulada na parte interna do quadro usando, de preferência, aspirador de pó com ponteira plástica e um pequeno pincel isento de óleos, tintas, graxas, etc.

8.3.3 Manutenção trimestral

- Fazer um reaperto geral em todos os parafusos que contenham ligações elétricas;
- Verificar a precisão de ajuste dos sensores, bem como da sua atuação;
- Verificar ajustes dos temporizadores em geral;
- Testar todos os sobressalentes;
- Testar o sistema de sinalização e comando por interrupção de fusível, usando um fusível de alarme queimado como simulador.





NOTA

- Fazer o GMG funcionar, manual ou automaticamente, pelo menos duas vezes por mês, de preferência com carga, comprovando assim o bom funcionamento do mesmo.
- Examinar durante o funcionamento do GMG, a temperatura dos relés, contadores, transformadores, etc.
- Em complemento a este manual, devem ser executados todos os procedimentos contidos nos manuais dos fabricantes do motor e gerador.



9. Garantia

9.1 Termo de Garantia STEMAC

Cobertura

Estão cobertos pela garantia os produtos e serviços comercializados pela STEMAC que apresentem defeitos provenientes de falhas de fabricação e/ou mão de obra, comprovados por análise técnica, e dentro do prazo vigente da garantia.

Prazos de Garantia

- Para equipamentos novos: 12 (doze) meses sendo 3 (três) meses de garantia legal mais 9 (nove) meses de garantia STEMAC.
- Para equipamentos usados: 6 (seis) meses sendo 3 (três) meses de garantia legal mais 3 (três) meses de garantia STEMAC.

O prazo da garantia passa a contar a partir da Entrega Técnica (primeiro funcionamento do equipamento), desde que esta seja solicitada até 90 (noventa) dias da data de emissão da Nota Fiscal do equipamento e executada pela STEMAC S/A GRUPOS GERADORES.

Caso não ocorra a situação citada acima, a garantia passa a ter um prazo de validade de 12 (doze) meses a partir da data de emissão da nota fiscal do equipamento. Neste caso, é necessário que se observem com rigor as recomendações do **capítulo 3** deste manual, no que se refere a correta armazenagem do equipamento.

Os equipamentos que permanecem depositados e/ou inoperantes por período superior a 4 meses, deverão ser submetidos obrigatoriamente a procedimentos de revisão antes da Entrega Técnica, podendo ocasionar custo não cobertos por esta garantia.

NOTA

A STEMAC S/A Grupos Geradores reserva-se ao direito de modificar as especificações e/ou introduzir aperfeiçoamentos nos projetos e configurações de seus produtos, em qualquer época, sem incorrer na obrigação de aplicá-los em produtos anteriormente comercializados.

Condições da Garantia

A Garantia aplica-se exclusivamente ao escopo do fornecimento da STEMAC S/A GRUPOS GERADORES. Desde que o equipamento esteja instalado conforme detalhado no manual de instruções do produto, em condições normais de uso e operação, de acordo com regime de funcionamento estabelecido no ato da compra (stand by/emergência, prime/horário de ponta ou base power/contínuo).

Limitações da Garantia

Não estão cobertas por garantia, equipamentos que apresentem as seguintes características:

1. Que se encontrem fora do período de garantia;
2. Danos causados por operação e/ou uso inadequado;
3. Avarias resultantes da ação de elementos naturais, tais como: pó, água, fogo, etc;
4. Não execução das revisões estabelecidas nos manuais da STEMAC S/A GRUPOS GERADORES e/ou do fabricante;



5. Lacres violados ou peças que apresentem marcas de violação;
6. Falhas de operação originadas pela necessidade de parametrização/ajuste específico, no caso de peças adquiridas sem o respectivo serviço de instalação;
7. Serviços, peças ou acessórios que tiverem sido alterados ou reparados por mão de obra não autorizada pela STEMAC S/A GRUPOS GERADORES;
8. Defeitos ou falhas advindas de acidentes e/ou causas naturais como: descargas atmosféricas, ambientes agressivos (ácidos, maresia, alta umidade, etc);
9. Mau uso ou negligência do operador;
10. Não observância das normas de manutenção e instalação;
11. Prática incorreta de armazenagem;
12. Utilização de componentes e/ou acessórios não recomendados e homologados pela STEMAC S/A GRUPOS GERADORES.
13. Não estão cobertas por esta garantia peças do tipo consumíveis, considerados itens de manutenção rotineira tais como: filtros, mangueiras, correias, fusíveis, lâmpadas, fluídos, etc.
14. A STEMAC S/A GRUPOS GERADORES não se responsabiliza por perdas do tipo lucro cessante, multas, aluguel de equipamentos e quaisquer outros tipos de perdas pessoais ou financeiras.
15. A STEMAC S/A GRUPOS GERADORES se reserva o direito de definir o local onde se dará a análise, o atendimento e/ou a reparação, seja do serviço ou da peça do equipamento.
16. No caso específico de garantia dos motores e geradores, a garantia é concedida pela STEMAC S/A GRUPOS GERADORES conforme descrito nos manuais específicos dos respectivos fornecedores.

Em caso de dúvidas, referente a garantia, contate a STEMAC S/A GRUPOS GERADORES pelo número 0300 789 38 00.



CONSIDERAÇÕES GERAIS

A STEMAC reserva-se o direito de:

- Devolver o equipamento reparado ou entregar outro com as mesmas características;
- Repor o equipamento danificado somente após análise técnica;
- Se o Serviço e/ou a Análise Técnica STEMAC constatar que o equipamento não está coberto pelos termos desta garantia, será emitido laudo técnico e orçamento para realização do reparo;
- Equipamentos que permanecerem nas dependências da STEMAC por um período superior a 03 (três) meses da data do orçamento, sem aprovação do mesmo, estarão sujeitos a cobrança de taxa de armazenagem;
- O presente termo de garantia é aplicável unicamente aos produtos comercializados pela STEMAC e não reconhece quaisquer outros compromissos assumidos, por quem quer que seja relativo a esses produtos;
- A STEMAC poderá, a qualquer tempo, modificar e alterar as condições da presente "Política de Garantia". Neste caso as novas condições somente serão válidas, e aplicáveis aos produtos adquiridos pelo consumidor final, após a data de sua divulgação pela STEMAC, mantendo-se inalterável para os produtos adquiridos anteriormente;
- As análises técnicas a serem realizadas nos produtos sob garantia, obrigatoriamente devem ser executadas nos laboratórios STEMAC, ou na autorizada do respectivo fabricante sob acompanhamento da STEMAC.



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