International Association of Oil & Gas Producers

SPECIFICATION
S-714-1J

September
2022

Specification for Diesel Generator Package (ISO/IEC Offshore)

NOTE This version (S-714-1J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-714-1.

Public Review Draft

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
0.1	September 2022	Issued for Public Review

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Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

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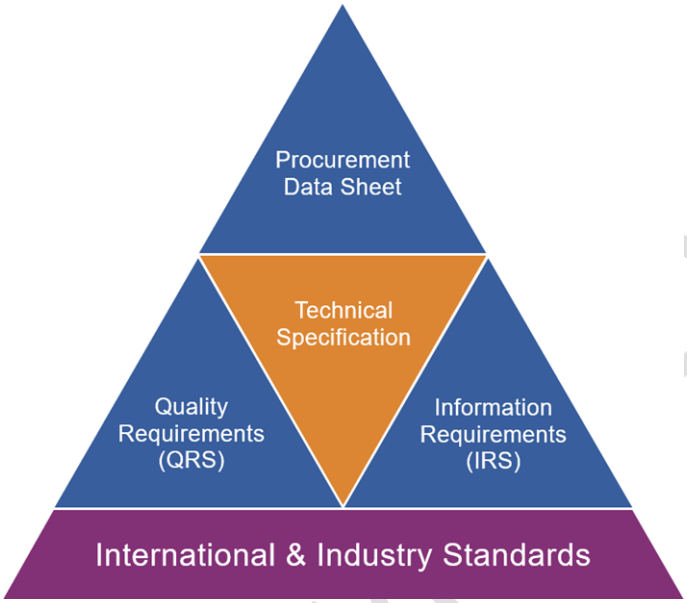
Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of diesel generator package (ISO/IEC Offshore) for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.



JIP33 Specification for Procurement Documents
Technical Specification

This specification is to be applied in conjunction with the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows.

IOGP S-714-1: Diesel Generator Package (ISO/IEC Offshore)

This specification defines the technical requirements for the supply of the equipment.

IOGP S-714-1D: Procurement Data Sheets for Diesel Generator Package (ISO/IEC Offshore)

The procurement data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The procurement data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the procurement data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-714-1L: Information Requirements for Diesel Generator Package (ISO/IEC Offshore)

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

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IOGP S-714-1Q: Quality Requirements for Diesel Generator Package (ISO/IEC Offshore)

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data sheet or in the purchase order.

The terminology used within this specification and the supporting procurement data sheet, IRS and QRS is in accordance with ISO/IEC Directives, Part 2.

The procurement data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser defined requirements (procurement data sheet, IRS, QRS);

d) this specification.

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1 Scope

1.1 Scope definition

This specification provides technical requirements for the supply of diesel generator packages for use in offshore fixed and floating production facilities using ISO and IEC standards.

Justification

The application applies to offshore diesel generator ISO/IEC installations, i.e. regions not covered by North American standards.

1.2 Scope boundaries

This specification is applicable to:

— emergency generators;

— essential generators;

— main generators.

NOTE 1 Emergency generators are intended to supply the emergency system in the event of failure of the supply from the main source of electrical power [SOURCE: IEC 61892-2:2019, 3.1.33.1, modified – the term has been truncated to “emergency” and domain added].

NOTE 2 Essential generators are intended to supply the services necessary to maintain the plant in a habitable condition and the equipment necessary for asset preservation, standby and restarting [SOURCE: IEC 61892-2:2019, 3.1.33.2, modified – the term has been truncated to “emergency” and domain added].

NOTE 3 Main generators are intended to supply all services necessary for maintaining the plant in a normal operational and habitable condition [SOURCE: IEC 61892-2:2019, 3.1.33.3, modified – the term has been truncated to “emergency” and domain added].

Justification

This is to ensure the correct usage of this specification.

1.3 Exclusions from scope

This specification does not apply to:

— diesel generators for supplying power to a firewater pump drive motors;

— diesel generators installed in hazardous area.

Justification

These are not common applications for offshore installations and their inclusion would generate the need for additional requirements.

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2 Normative references

The following publications are referred to in this document, the procurement data sheet (IOGP S-714-1D) or the IRS (IOGP S-714-1L) in such a way that some or all of their content constitutes requirements of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the references document (including any amendments) applies.

ASME BPVC, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*

ASTM D975, *Standard Specification for Diesel Fuel*

EN 590, *Automotive fuel – Diesel – Requirements and test methods*

EN 13445, *Unfired pressure vessels*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61892-3:2019, *Mobile and fixed offshore units – Electrical installations – Part 3: Equipment*

IEEE C37.2, *IEEE Standard Electrical Power System Device Function Numbers, Acronyms, and Contact Designations*

ISO 8528-1 , *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance:*

ISO 8528-2, *Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines*

ISO 8528-3 , *Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets*

ISO 8528-4:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 4: Controlgear and switchgear*

ISO 8528-5:2018, *Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets*

ISO 8528-6:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 6: Test methods*

ISO 10816-6:1995, *Mechanical vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 6: Reciprocating machines with power ratings above 100 kW*

ISO 12944-1, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction*

ISO 12944-2, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments*

ISO 16890-1:2016, *Air filters for general ventilation — Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)*

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3 Terms, definitions and acronyms

3.1 Terms and definitions

3.1.1

control panel

panel of a diesel generator package that provides system monitoring, controls and protections for the diesel engine and the a.c. generator in one location

3.2 Acronyms

a.c. alternating current

RTD resistance temperature device

4 Application, ratings, performance and testing of diesel generator packages

4.1 Compliance

The diesel generator package shall comply with ISO 8528-1 to -6.

Justification

ISO 8528 series define design and performance requirements for diesel generating sets for various modes of operation (e.g. continuous operation at constant load, continuous operation at varying load and limited time operation at varying load) as applied to oil and gas industry installations. The diesel generator is sized in accordance with ISO 8528 series.

4.2 Interfaces

Utility and service interfaces shall be singular at the diesel generator package skids.

Justification

Utilities identified for operation of the diesel generator package are specified by the purchaser in the data sheet. The supplier distributes the utilities to the consumers within the package.

4.3 Interface termination

Utility and service interfaces shall terminate at skid edge flanges, at junction boxes or at the control panel.

Justification

The supplier distributes the utilities (e.g. diesel supply, engine exhaust, drain, vent) to the consumers within the package. This eliminates field work by the purchaser inside the package skid for hook-up at the yard. Similarly, supplier interface for instrumentation is terminated in junction boxes and utility power supply interfaces are at the control panel.

4.4 Cable entries

Open cable entries shall be fitted with sealing plugs.

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Justification

This to ensure temporary protection from ingress of dirt, moisture in the junction boxes and terminal boxes during transportation and storage.

4.5 Cables

Power and instrument cables shall be flame retardant, low smoke and low halogen type.

Justification

Flame retardant, low smoke and low halogen type cables are used in offshore installations to resist the spread of fire into a new area while avoiding health and safety issues to the operating personnel.

Flame retardant test IEC 60331
Testing for smoke - Minimum light transmission value of 60 %, conforming to IEC 61034-2
Testing for halogen - Maximum halogen gas emission of 0,5 %, conforming to IEC 60754-1 and IEC 60754-2

4.6 Fire and gas detection

4.6.1

The release of fire suppressant shall be activated from the facility fire and gas system via a hard-wired signal to the supplier control panel.

Justification

The fire and gas system arranged by the purchaser is the only place to monitor the presence of fire and hydrocarbon gas on the facility, and it provides a signal for action in the event of an incident in that facility to various safety provisions made on the facility. Therefore, the fire suppressant release command is sent to the supplier control panel when the fire suppression provision is made by the supplier for the diesel generator package, typically in a diesel generator package with enclosure.

4.6.2

Fire and gas detectors shall be installed and wired inside the diesel generator package enclosure.

Justification

Fire and gas detector selection and placement is critical in supporting the protection to the package from fire and gas incident. This eliminates wiring work inside the diesel generator package in the yard during installation.

4.7 Baseplate

4.7.1

The baseplate shall be designed for a single-point lift.

Justification

This is to facilitate lifting of the diesel generator package from a single crane hook and position easily on the foundation.

4.7.2

The baseplate shall be continuously welded.

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Justification

This is to impart structural integrity to the baseplate and ensure safe lifting.

4.7.3

The baseplate shall have a continuously welded secondary containment with a flanged drain.

Justification

Diesel generators use diesel fuel, lube oil and cooling medium for operation, and primary containment for each of the fluids is included within the respective package components. The possibility of leakage always exists, leading to leaked fluids posing a potential risk of fire or flowing into the sea causing pollution. Therefore, the secondary containment, by covering the complete baseplate to retain the leaked fluids, is made by the supplier. The purchaser can drain such leaks safely into the drain system provided in the facility.

4.7.4

Baseplate mounting pads shall be flat and parallel with each other to within 0,15 mm/m (0,002 in/ft).

Justification

This is to ensure contact between the underside of the mounting feet/shim and the mounting surface.

4.7.5

The surface finish of baseplate mounting areas shall not exceed Ra 3,2 µm (125 µin).

Justification

This is to ensure good contact between the face of the mounting feet/shim and the mounting surface.

4.8 Flanged openings

Flanged openings shall be provided with sealed protective covers made of weatherproof material.

Justification

This is to prevent ingress of moisture and rainwater inside the diesel generator package components, which can accelerate corrosion.

4.9 Provision for removal

The diesel generator enclosure shall have provision for the removal of the generator and the diesel engine.

Justification

Access for periodic and major servicing needs of components within the diesel generator enclosure is required. Openable doors are always provided for access to components for periodic inspection and maintenance. Major maintenance of the diesel engine or generator can only be carried out in designated workshops, therefore, removable panels are provided in the enclosure to assist such activities.

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4.10 Testing

The diesel generator package shall be tested in accordance with ISO 8528-6:2005, Clause 5.

Justification

The diesel generator package undergoes ISO standard function test in accordance with ISO 8528-6 as a minimum verification test before delivery. The test will be conducted according to the approved test procedure.

5 Engines

5.1 Starting systems

5.1.1

Diesel engines in emergency generator service shall have two independent starting systems.

Justification

Two independent starting systems of cranking increases the reliability of the starting system of the diesel engine. A combination of electric, pneumatic and hydraulic starter systems are used for primary and a backup secondary system.

5.1.2

Diesel engines with two independent starting systems shall have an automatic changeover device.

Justification

In case of failure of the first starting system during starting, automatic changeover will engage the second starting system.

5.1.3

Starting systems shall be rated for handling three consecutive cranking cycles, each of 15 s of cranking and 15 s of rest, without recharging the battery or pressurizing the air vessel or hydraulic oil accumulator.

Justification

This is to set minimum starting system sizing criteria based on three cranking cycles. Three cranking cycles is assumed according to the following scenario, first unsuccessful cranking attempt, second unsuccessful cranking attempt, investigate and fix problem, and then make the third successful cranking attempt.

5.1.4

If the diesel engine fails to start after a complete cycle of cranking attempts, the starting sequence shall be aborted with a "failure to start" indication in the control panel.

Justification

This is to alert the operator on the starting system malfunction.

5.1.5

Hydraulic oil pumps shall be sized to recharge the accumulators within 15 min.

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Justification

This is to set a sizing criteria for the hydraulic oil pump to fill the accumulators within a reasonable time. 15 min is considered a reasonable time based on refill of the accumulators due to a previous failed start attempt.

5.1.6

Air and hydraulic starting systems shall be provided with system isolation valves.

Justification

Isolation valves in air and hydraulic starting systems will be closed when maintenance work is scheduled for the systems. This allows work to be carried out safely.

5.1.7

Direct injection starting systems shall have double check valves between the air source and the engine.

Justification

This is to prevent backflow of gas from the engine cylinder to the starting air system.

5.2 Overspeed detection

Diesel engines shall have two independent speed sensors with shutdown of the engine occurring when one of the sensors detects an over-speed.

Justification

This is to prevent the engine over-speeding beyond the engine limit, which can cause potential engine damage and personal injury.

5.3 Batteries and chargers

5.3.1

Batteries shall be located in a naturally ventilated compartment.

Justification

Due to chemical reaction during charge/discharge, batteries emit hydrogen gas. The rate and amount of emission of hydrogen gas depends on the battery technology. Hydrogen gas can form an explosive mixture if allowed to accumulate, i.e. if hydrogen concentration crosses LEL. Hence a natural ventilation arrangement in the battery storage compartment/enclosure will ensure that the hydrogen gas gets removed and does not form an explosive mixture.

5.3.2

Batteries shall be provided with two-pole isolators.

Justification

A two-pole type isolator is the minimum requirement to isolate the batteries for safe maintenance work.

5.3.3

The battery charger shall have output surge protection.

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Justification

Batteries are sensitive to abrupt variations in input voltage and input current. The cause of surge could either be due to external factors at the input side of the charger or malfunction inside the charger. In order to protect the batteries, the charger units have features such as current limit (limit over current) and surge protection (limit voltage spike/surge).

5.4 Inlet and exhaust systems

5.4.1

Diesel engine air pre-filters shall be rated for a filtration efficiency class of ISO ePM10 50 % or higher, in accordance with ISO 16890-1:2016, Table 4.

Justification

The required filter rating ensures that large particles are not ingested into the combustion chamber where they could cause wear and damage.

5.4.2

Diesel engine air filters shall have a service indicator.

Justification

This is to monitor the filter condition and schedule its change-out.

5.4.3

Diesel engines with air inlet ducting shall be provided with expansion bellows.

Justification

This is to isolate transmission of the engine vibrations to the duct.

5.4.4

The exhaust silencer of a diesel engine in an enclosure or container shall be located outside the enclosure or container.

Justification

Exhaust silencers are large components that should be located outside of an enclosure or container to allow the maximum space possible inside for inspection and maintenance of equipment.

5.5 Cooling systems

5.5.1

Radiators or external air coolers shall be designed for 110 % of the heat load at the maximum engine power, at the maximum ambient design temperature.

Justification

This is to ensure that fans are adequately sized to handle short-term engine overload and performance deterioration. This is a typical overdesign practice in the industry.

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5.5.2

Water-cooled heat exchangers shall be designed for 110 % of the maximum heat load at the maximum cooling medium inlet temperature.

Justification

This is to ensure normal engine cooling during an engine overload or high fouling on exchanger tubes. This is a typical overdesign practice in the industry.

5.5.3

The cooling system shall have a high-point vent.

Justification

This is to facilitate draining and venting of the system during maintenance and start-up.

5.5.4

The cooling system shall have a low-point drain.

Justification

This is to facilitate draining and venting of the system during maintenance and start-up.

5.5.5

Charge air coolers shall have a condensate draining feature.

Justification

This is to prevent condensate entering the engine.

5.5.6

Radiator fan blades shall be made of a non-sparking material.

Justification

This is to prevent formation of sparks in the fan blades which may act as an ignition source.

5.6 Crankcase

5.6.1

The diesel engine crankcase shall have an explosion relief device with a flame arrestor.

Justification

This is to limit the likelihood of an explosion that can occur due to an internal engine failure. The installed flame arrestor prevents further escalation.

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5.6.2

When not routed to the engine air intake, the diesel engine crankcase breather outlet shall be flanged at the skid edge.

Justification

The purchaser routes the piping from the crankcase breather outlet at the skid edge to a safe location for disposal of gases.

5.7 Vibration

5.7.1

Vibration points, direction and limits shall be in accordance with ISO 10816-6:1995.

Justification

This is the acceptance criteria for vibration measurement for diesel engines.

5.7.2

Data and vibration calculations for torsional analysis shall be in accordance with ISO 8528-5:2018, 14.10.

Justification

This is required to help the package supplier carry out torsional and lateral analysis for the complete drive train as it provides requirements for measurement, calculation and reporting of torsional vibration. ISO 8528-5, 14.10.2 refers to ISO 3046-5 for performing torsional vibration analysis.

5.8 Personnel protection

5.8.1

In areas that are accessible during operation and inspection, protection against potential injury from surfaces exceeding 60 °C (140 °F) shall be provided.

Justification

Protection from hot surface hazard is required to protect personnel form potential injury. 60 °C (140 °F) is an accepted industry practice.

5.8.2

Insulation used to reduce surface temperature shall be impermeable.

Justification

Impermeable insulation reduces the risk of soaking the insulation with diesel or lubricant liquids and thereby, avoids the risk of fire due to liquid auto-ignition upon contact with hot surfaces.

5.9 Guards

5.9.1

Couplings and flywheels shall have guards.

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Justification

This is to prevent personnel injury due to exposure to unenclosed rotating component.

5.9.2

Coupling guards shall be made of a non-sparking material.

Justification

The selection of construction material for guards around rotating shaft, fan, belt drives, etc. is made by the supplier in a diesel generator for offshore installation such that it does not produce sparks in the event of a rotating part making contact with the guard. Generally, brass or suitable grade of aluminium is used for construction of guards on offshore installations.

5.10 General

5.10.1

The direction of rotation shall be permanently marked on the drive end of the engine.

Justification

This is to verify that the engine shaft is rotated in the correct direction after maintenance and also matches the direction of rotation of the driven equipment.

5.10.2

Components over 25 kg (55 lb) requiring removal for maintenance shall have lifting lugs or provisions for lifting eyebolts.

Justification

Lifting lugs should be provided for mechanical handling of items to reduce the risk of injury to personnel. 25 kg (55 lb) is generally accepted as the limit above which mechanical handling provisions are required.

5.10.3

The fuel system filter element shall remove water and solids.

Justification

Diesel fuel is highly hygroscopic and readily absorbs water from moisture in the air. Temperature variations during day and night cause breathing of ambient air in the day tank which contaminates diesel fuel with water. This contamination of diesel with water is one of the main causes of engine damage. Water in diesel fuel must be removed.

5.10.4

Coupling adapters shall not be used for flywheel assembly when the crank shaft has an integrally-forged shaft end.

Justification

A coupling adapter introduces additional fits and clearances resulting in unbalance when the clearances change.

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6 Alternating current generators

6.1 Generator excitation

6.1.1

The synchronous generator exciter shall be a brushless type with a rotating rectifier bridge circuit.

Justification

The type of exciter used is required to be a rotating a.c. type with a rotating bridge rectifier as this type is part of the brushless design. It reduces the requirement for maintenance and gives desired performance characteristics. It utilizes a permanent magnet generator mounted on the shaft.

6.1.2

The excitation system field forcing capability shall be 300 % of the rated current for 7,5 s and 150 % of the rated current for 30 s.

Justification

The excitation system is required to provide sufficient output to enable the generator to support large changes in the load (e.g., starting of a large motor, short circuit situation).

6.2 Neutral conductor size

The neutral conductor of three-phase, four-wire systems of electrical power shall be equal to the phase conductor specification and size.

Justification

This requirement ensures that the neutral cross-sectional area equals that of line conductor. This is a good engineering practice which ensures that the neutral line is adequately specified and avoids potential requirement for over current protection of the neutral.

6.3 Generator winding insulation type

Generator stator windings shall be insulated using the vacuum pressure impregnation technique.

Justification

Generator windings are required to be insulated in order to prevent voltage breakdown of the windings, which would cause a malfunction and failure of the alternator. Vacuum pressure impregnation is the best method to seal the windings with resin and fill gaps in the materials to create void free insulation.

6.4 Insulated bearings

Bearing insulation shall be provided for generators with shaft voltage greater than 350 mV RMS value.

Justification

IEC machines are provided with insulated bearings when the measured shaft voltage is greater than 350 mV RMS value in accordance with IEC 60034-1:2022, 9.14.

6.5 Anti-condensation heater

Anti-condensation heaters shall be provided for the generator and the control panel.

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Justification

Anti-condensation heaters are provided to ensure that condensation does not deteriorate the insulation of the generator stator winding during idle periods of the package. Anti-condensation heaters within the generator stator windings and the control panel removes moisture that can cause an arc flash event or failure of components.

6.6 RTD junction box

Generator stator winding and bearing RTDs shall be wired to a dedicated junction box.

Justification

A separate RTD junction box helps preventing EMC interference and is safe for troubleshooting.

7 Control panel

7.1 Operation mode selector switch

The control panel shall have a "Manual-Test-Auto-Off" operation mode selector switch for a diesel generator in emergency service.

NOTE 1 The manual mode starts the diesel engine if a "start inhibit" condition does not exist.

NOTE 2 The test mode simulates an undervoltage signal to start the diesel engine and generate specified voltage and frequency, either manually or automatically, and initiates a "close" signal to the circuit breaker. The test mode allows the operator to load and unload the diesel generator package, open the circuit breaker and stop the generator to complete the test cycle.

NOTE 3 The auto mode selection starts the diesel engine automatically upon receipt of an undervoltage signal from the switchgear, generates specified frequency and voltage, synchronizes with the grid, and initiates a "close" signal to the circuit breaker.

Justification

The operating mode selector switch allows selection of a particular mode of operation of the diesel generator package to start. The diesel generator package supplier provides appropriate logic of sequence of operation stated in the note for each mode from a start to close signal to the circuit breaker.

7.2 Parallel operation

Generator sets specified for parallel operation shall have a control system and instrumentation in accordance with ISO 8528-4:2005, 6.12.

Justification

Parallel operation of generators is specified in most oil and gas facilities. Accordingly, a set of control functions and display of operating parameters are needed on the control panel for the generator. ISO 8528-4: 2005, 6.12, identifies such items and the supplier will arrange in the control panel.

7.3 Control panel earthing design

Control panel earthing shall comply with IEC 61892-3:2019, 4.14.

Justification

This ensures consistency of design and safe operation of control panel for offshore installations such that dangerous currents and voltages are not present.

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7.4 Electromagnetic compatibility

The electromagnetic compatibility of electrical equipment and instrumentation shall comply with IEC 61000-6-2 for immunity and IEC 61000-6-4 for emissions.

Justification

Electrical equipment on the diesel generator package is required to comply with EMC requirements in IEC 61000-6-2 for immunity and IEC 61000-6-4 for emissions. This enables proper functioning of the equipment and ensures that the equipment does not affect the operation of other equipment due to radio frequency interference (RFI).

7.5 Communication interface

7.5.1

The package control and monitoring system shall be time-synchronized with the facility control system.

Justification

Time synchronization allows analysis and evaluation of events in their true sequential order of occurrence on the facility.

7.5.2

The diesel generator package shall continue to operate when the communication interface fails.

Justification

Communication interface only carries non-critical data and hence the loss of this link does not compromise the package availability.

7.6 Interfaces for shutdown

The control panel shall have terminations for hardwired external signals.

Justification

Hardwired signals are more reliable than digital signals and also offer a high probability to execute a start or stop command in an adverse situation.

7.7 Control panel alarms, trips and shutdown functions

The generator status, alarm, trip and shutdown functions shall be in accordance with Table 1.

Justification

The control panel has added number of status, alarm, trip and shutdown functions, to protect the generator, and notify maintenance and operating personnel of the status of the generator.

7.8 Diesel engine monitoring, alarm and trip functions

Diesel engines shall have monitoring, alarm and trip functions in accordance with Table 2.

Justification

This is to define the minimum requirement on alarm, trip and monitoring conditions functions to ensure safe and reliable operation of the equipment.

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Table 1 — Generator status, alarm, trip and shutdown functions

Function	Status	Alarm	Trips for essential and main generator	Trips for emergency generator
Overcurrent – voltage restraint (51V)			X	X
Overcurrent (50/51)			X	X
Stator earth/ground fault [a] (51G)			X [c]	X [c]
Under voltage (27)		X	X	
Over voltage (59)		X	X [c]	
Under frequency (81U)		X	X	
Over frequency (81O)		X	X [c]	
Reverse power [b] (32R)			X [c]	X [c]
Negative phase sequence (46)			X	
Loss of excitation (40)			X	
Differential protection (87G) [d]			X	
Pole slipping (78)			X	
Overload (49)		X		
Overexcitation (24)			X	
Stator winding temperature high (49S)		X	X	
Diode failure (58)		X	X	
Rotor earth/ground fault (64)			X [c]	
Bearing temperature high (49B)		X	X [c]	
Local emergency shutdown (command)			X [c]	X [c]
Remote emergency shutdown (command)			X [c]	X [c]
External shutdown override status for generator	X			
Automatic voltage regulator failure		X		
Control panel common alarm		X		
Lock out general			X	
Generator circuit breaker "OPEN"	X			
Generator circuit breaker "CLOSED"	X			
Control/trip supply "ON"	X			
Generator "Not in Auto"	X			
Generator "Unavailable"	X			
Generator "Fail to start"	X			

Key
X: required

NOTE Device numbers are as per IEEE C37.2 and can also be used in IEC standard projects also.

[a] Where a restricted earth/ground fault relay is used for generator differential protection, the separate stator earth/ground relay may be omitted.

[b] Applicable only when parallel operation of the generator is specified.

[c] Shutdown of the engine is required in addition to generator trip.

[d] The generator supplier shall make mounting provision and termination of purchaser's supplied differential protection current transformers in the generator neutral terminal box.

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Table 2 — Monitoring, alarm and trip functions

Condition	Indication	Alarm	Trip
Engine speed (H, HH) [c]	X	X	X
Engine vibration (H, HH)	X	X	
Lube oil supply temperature (H, HH)	X	X	
Lube oil supply pressure (L, LL)	X	X	X
Lube oil filter differential pressure (H)	X	X [a]	
Lube oil sump level (L, LL)	X	X	X
Jacket water temperature (H, HH)	X	X	X
Expansion tank level (L)	X	X	
Inlet air filter differential pressure (H)	X	X [a]	
Temperature of charge-air downstream of cooler (H)	X	X [a]	
Main fuel filter differential pressure (H)	X	X [a]	
Fuel pre-filter differential pressure across (H)	X	X [a]	
Day tank fuel level (L)	X	X	
Engine service-hours meter	X		
Radiator cooler fan vibration high (H)	X	X	
Emergency stop (HH)	X		X [b]
Abort of engine starting	X		

Key

X: required

[a] Continuous operation only.

[b] Diesel engines in emergency diesel generator service shall have trip interlocks bypassed while in "Auto" mode of operation, except for overspeed trip and emergency stop.

[c] Overspeed trip system shall be provided in accordance with ISO 8528-6:2005.

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