



**SPECIFICATION**  
for  
**SYNCHRONOUS GENERATOR**

(11032KVA, 10P, 13800V, 60Hz, 60SETS)

**RE APPROVAL**

1		Re Approval			-	
0		For Approval			-	
<b>Rev.</b>	<b>Date Issued</b>	<b>Contents</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Checked by</b>	<b>Approved by</b>

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## \* SPECIFICATION FOR 10954KVA GENERATOR

The specification describes 60 sets of three-phase synchronous brushless generator.

- 11032 KVA x 60SETS

### 1. GENERAL DESCRIPTION

#### 1.1 SCOPE OF SUPPLY

##### 1.1.1 ESSENTIALS (PER 1 GENERATOR)

- (1) One(1) set of synchronous generator
- (2) One(1) unit of automatic voltage regulator with automatic power factor control.

##### 1.1.2 ACCESSORIES (PER 1 GENERATOR)

- (1) One(1) unit of space heater.
- (2) One(1) unit of winding temp. detector(PT100 ohm x 2pc/phase).
- (3) One(1) unit of bearing temp. detector(PT100 ohm x 1pc/bearing).
  - Lubrication oil sight-glass for monitoring.(for each bearing)
- (4) Two(2) unit of earth terminal.
- (5) One(1) unit of main terminal box./Auxiliary terminal box.
  - (Inclusive suitable cable glands for bottom entry)
- (6) Two(2) units of current transformer for current boosting
- (7) Six(6) units of current transformer for differential protection
  - 3 pcs : For generator installation
- (8) One(1) unit of current transformer for current sensing
  - (For generator installation)
- (9) One(1) unit of power transformer for AVR input power
- (10) One(1) unit of loose part (jacking bolt & taper pin)

#### 1.3 LANGUAGE AND UNITS

The English language and metric system will be used in all drawings,  
Manual and name plates will be made with English & Portuguese language.

#### **1.4 SITE CONDITIONS**

The generators shall be designed, taking into account of the following site conditions.

- Location : Indoor
- Altitude : Below sea level 1000m
- Ambient temperature : Max. 40 °C
- Relative humidity : Max. 95 %

#### **1.5 TEST AND INSPECTION**

The test and inspection on the generator shall be carried out in accordance with applicable standard and customer's requirement.

#### **1.6 PAINTINGS**

All parts of iron surface will be coated with anticorrosive painting in accordance with manufacturer standard. The finished color of exterior surface is as follows according to customer's request.

Unless otherwise specified, generator will be finally coated with the generator : LATER ON

## **2. MECHANICAL SPECIFICATION**

### **2.1 CONSTRUCTION**

The generators comprise rotating-field machines in which the salient pole rotor carrying the D.C-excited field winding and the damper winding rotates inside the stator which carries the A.C output winding.

The generators incorporate an A.C exciter and rotating rectifiers mounted on the shaft, which provide the excitation current for the main machine.

### **2.2 DEGREE OF PROTECTION**

The generator enclosure is designed to comply with degree of protection IP23(IEC34-5)

### **2.3 COOLING**

The cooling of the internally-ventilated generators is in accordance with IEC34-6(IC2A1)

A fan at the drive end draws the cooling air axially through the machine.

### **2.4 TYPE OF CONSTRUCTION**

B20 with double sleeve bearing.

### **2.5 BEARING**

- Sleeve bearing.

### **2.6 LUBRICATION**

- Self lubrication

### **2.7 SPEED AND DIRECTION OF ROTATION**

The nominal frequency is produced at the rated speed.

Unless otherwise stated a speed rise of 5% when the load reduced from the rated value to zero will be assumed.

Direction of rotation is counter clockwise (C.C.W) viewed from drive end.

### **2.8 MAIN TERMINAL BOX FOR HIGH VOLTAGE POWER**

Degree of protection : IP54

4 leads wired out : U, V, W, N

Terminal box is located on the left side when viewed from drive end.

### **2.9 ANTI-CONDENSATION HEATER**

Generator will be provided with AC 230V heater to prevent condensation while the machine is shut down.

Heater will be arranged to provide even distribution of heat.

The leads from the heater will be brought out to clearly labelled terminal.

A.C. 1 Phase 230V, 1000W

### 2.10 OVERSPEED STRENGTH

The generator shall be free from mechanical faults when operated at 120% of rated speed for 2 minutes under no load and non excited condition.

### 2.11 ROTOR

Cylindrical (non-salient pole) rotor

Moment of inertia ( $GD^2$ )

: APP. 10,624 kg-M<sup>2</sup>

Weight of rotor

: APP. 12,040 kg

### 2.12 WEIGHT OF GENERATOR

: APP. 30,500 kg

### 2.13 DIMENSION OF GENERATOR

: APP. L3820 x W2747 x H2643

### 3. ELECTRICAL SPECIFICATION

#### 3.1 INSULATION

Class F insulation is used as a standard feature for the generator.  
This protects the winding against corrosive gas, vapor, dust and oil.

#### 3.2 STATOR WINDING

The three phase stator winding is the double-layer type and star connected.

The four stator lead ends U, V, W, N and exciter pole connection + F1 and - F2, are brought out to the cable connection box.

#### 3.3 ROTOR WINDING

The rotor winding is wound on the salient pole core.

The generator is fitted with a damper winding, i.e. a cage of bars connected by rings, which lies in special slots in the rotor.

#### 3.4 EXCITING SYSTEM

Self-exciting brushless system with rotary exciter mounted on the generator frame.

#### 3.5 VOLTAGE ADJUSTMENT

The rated voltage can be adjusted with  $\pm 10\%$  any load using increase/decrease digital input when the power factor is between 0.8 and 1

#### 3.6 STEADY-STATE VOLTAGE VARIATION

Throughout the range from no-load to rated load at rated power factor and rated speed with nominal excitation control system including an A.V.R., the voltage variation under steady condition is within  $\pm 1.0\%$  of rated voltage.

#### 3.7 INSTANTANEOUS VOLTAGE VARIATION

With a load corresponding to 60% (power factor: less than 0.4) of rated current applied at rated voltage and frequency, the instantaneous voltage variation factor shall be less than 15% and shall be restored to  $\pm 3\%$  of the final voltage with 2 seconds.

#### 3.8 EFFICIENCY

The efficiency allows for the total losses in the generator, including those of the field winding and excitation system.  
The values at rated output shall be guaranteed over 97.2%.

#### 3.9 OVERLOAD

In accordance with applicable standard, the generator can have an overcurrent of 1.5 times the rated current at rated voltage for 30 seconds.  
The generator shall be operated at 110% rated current for one hour within any 12-hour period at no risk of critical temperature rise.

### 3.10 TEMPERATURE RISE

Temperature rise at full load and rated power factor.

- 1) Stator coils : Not to exceed 105°C by resistance method.
- 2) Rotor coils : Not to exceed 110°C by resistance method.

Temperature rise is based on intake air not exceeding 40 °C and altitude not exceeding 1000 meters in accordance with IEC 60034-1

### 3.11 AUTOMATIC VOLTAGE REGULATION (AVR)

A digital single channel excitation system (UNITROL1000) is installed on a mounting plate to be integrated into the generator control panel.(GCP)

Features :

- Voltage regulation within 0.25% from no-load to full-load.
- Proportional(P), integral(I) and derivative(D) stability control.
- Under frequency limiter or V/Hz ratio limiter.
- Paralleling compensation of two or more generators using reactive droop.
- Manual and automatic mode.
- Several protection functions.

Serial bus coupling for read out of different measuring values.

### 3.12 CONDITION OF GENERATOR OPERATION

- 1) Operation S1, continuous
- 2) operation mode : Parallel with national grid and island mode.



## SPECIFICATION OF GENERATOR

USE	DIESEL ENGINE GENERATOR		QUANTITY / SHIP	60 SETS				
TYPE OF ENCLOSURE	IC2A1		APPLIED CLASS	-				
COOLING SYSTEM	AIR TO AIR		AMBIENT TEMP.	40 °C				
EXCITING SYSTEM	SELF EXCITING BRUSHLESS		INSULATION CLASS	F				
STRUCTURE OF ROTOR	SALIENT POLE ROTOR		TEMPERATURE RISE	F				
COUPLING METHOD	FLEXIBLE		APPLIED UNIT	METRIC				
<b>SPECIFICATION</b>			<b>BEARING</b>					
TYPE	HAR7 189-1028		TYPE OF BEARING	SLEEVE BEARING				
OUTPUT CAPACITY	11032.0 KVA		LOCATION	DRIVED END	NON-DRIVED END			
RATING	CONTINUOUS		SIZE	PH280 X L250	PH280 X L213.2			
PHASES, WIRE, CONN	3 $\Phi$ , 4 W, Y (DAMPER WINDING)		OIL QUANTITY	34 Liter	34 Liter			
VOLTAGE	AC 13800 V		LUB SYSTEM	SELF	SELF			
CURRENT	461.5 A		OIL GRADE	ISO VG 46				
FREQUENCY	60 Hz		INLET PRESSURE	N/A				
POLES	10 P		INLET TEMP.	N/A				
SPEED	720 RPM		<b>AIR DATA</b>					
POWER FACTOR	0.8 LAGGING		COOLING AIR VOLUME	8.34 m <sup>3</sup> /sec				
GD <sup>2</sup> / J	10624.0 Kg.m <sup>2</sup> / 2656 Kg.m <sup>2</sup>		PRESSURE DROP	5.9 mmAq.				
ROTOR WEIGHT	12040 Kg							
TOTAL WEIGHT	30.5 ton							
<b>CHARACTERISTICS</b>								
OVER CURRENT	150 % / 30 second							
VARIATION OF GENERATOR VOLTAGE	$\pm 2.5$ %							
OVER SPEED	120 % / 2 min.							
VOLTAGE ADJUST	$\pm 10.0$ %							
MOUNTING METHOD	IM1101(B20)							
<b>REACTANCE</b>			<b>TIME CONSTANT</b>					
	SATURATED	UNSATURATED	Ta : 0.058 sec	COOLING AIR TEMP	-			
Xd	1.33%	160%	T'd : 0.67 sec	LEAKAGE DETECTOR	-			
Xq	-	74.5%	T" d : 0.006 sec	<b>CONFIRMED ITEM BY OWNER</b>				
X'd	0.225%	25.6%	T'do : 3.9 sec	* LOCATION OF TERMINAL BOX. (VIEW FROM PRIME MOVER)	MAIN : LEFT SIDE AUX. : LEFT SIDE			
X" d	0.121%	14.6%	T"do : 0.096 sec	* CABLE ENTRY	BOTTOM SIDE			
X" q	0.121%	14.5%	T"qo : 0.070 sec	* SPACE HEATER	1PH, 230V, 1000W			
X0	-	5.5%	T"q : 0.012 sec	* PAINTING COLOR	LATER			
X2	0.121%	14.5%	Short circuit ratio kc:0.75	* LOCATION OF AIR COOLER FLANGE (VIEWD FROM PRIME MOVER)				
Xp	0.203%	-	Stored energy constant : - 0.684 sec.	* ROTATING DIRECTION OF GENERATOR (VIEWD FROM PRIME MOVER)	C.C.W			
X1	-	9.2%						
<b>NOTE</b>								
*ALARM & TRIP VALUE			<b>REMARK</b>					
- WINDING TEMPERATURE DETECTOR : 150°C/155°C			1.THE SPECIFICATION OF * MARK SHOULD BE INFORMED ON YOUR APPROVED DRAWING					
- BEARING TEMPERATURE DETECTOR : 95°C/100°C								
REV	CONTENTS		DATE	HAR7 189-1028-REV.1				
1	REVISED OF UP-DATA			DATE	DESIGN	CHECKED	CHECKED	APPROVED
2								
3								