APPENDIX - III

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

Doc. No. : PRTD/AR/**PF:03**	Issue No. : 1	Issue Date 28 Apr 2020	**Report of Action Research**

1.	**Action Research Project No.** *(as assigned by PRTD)*	AR-0056
2.	**Title of the Action Research Project**	Study on Non- Implementation of standards in the field of AC Generators driven by Internal Combustion Engine
3.	**Name & Designation of Officer**	Dhinesh Rajagopalan L, Scientist-C
4.	**Deptt./BO/RO & Place of Posting**	BO Certification – Kochi Branch Office
5.	**Date of Approval of the Project**	12 June 2020
6.	**Objective of the Project**	• To know about challenges faced by manufacturers of AC Generators in implementation of the Indian Standard • To enable BIS to bring manufacturers of AC generators under Product Certification Scheme
7.	**Report of Action Research Activities**	Attached in Annexure 1
8.	**Conclusion & Recommendations**	
9.	**Any other relevant information**	Nil

28 Apr 2021

Sign. of Officer

Head of Deptt./BO

Activity Head

DDG(PRT)

ANNEXURE 1

Aim : Study on Non- Implementation of Indian Standards in the field of AC Generators.

Research Methodology Adopted :

a) Study of Indian Standards 13364 (Part 1), IS 13364 (Part 2) and referred Indian Standards
b) Based on Interaction with manufacturers of Generators
c) Study of International Standards IEC 60034 (Part 22) - Rotating electrical machines – Part 22: AC generators for reciprocating internal combustion (RIC) engine driven generating sets and IEC 88528-11 Reciprocating internal combustion engine driven alternating current generating sets Part 11: Rotary uninterruptible power systems Performance requirements and test methods
d) Based on interaction with laboratories
e) Study of CPCB guidelines

Background :

Electricity is one of the most important blessings that science has given to mankind. Most kinds of activities whether they are commercial, industrial or household need electricity to perform.

When the grid power supply is interrupted due to a power cut, daily life activities of several dependents come to halt. In such cases, generators as external sources of electric power come to the rescue.

Being a National Standards body and considering the importance of continuous power supply, BIS has developed IS 13364 (Part 1) and IS 13364 (Part 2) for AC generators (alternators) driven by internal combustion engines as below

IS 13364 (Part 1) covers the requirements of AC generators of rated outputs upto 20 KVA
IS 13364 (Part 2) covers the requirements of AC generators of rated outputs above 20 KVA and upto 1250 KVA

Even though there are large number of generator manufacturers in India, there is no BIS licensee for IS 13364 (Part 1) and IS 13364 (Part 2) till now.

This study will enable BIS to understand, what are the difficulties faced by manufacturers of generators in getting BIS certification marks licence.

REPORT OF ACTION RESEARCH

OVERVIEW OF DG SET & ALTERNATORS :

DG set is an electromechanical device which converts mechanical energy to electrical energy. The generated electrical energy is in the form of an alternating current sinusoidal output waveform. In case of Diesel Gen-sets, the mechanical energy is provided by the diesel engine.

A typical DG set is shown in figure 1

Fig 1: DG Set

A typical DG set comprises of the following

a) Diesel Engine
b) Alternator
c) Cooling and Exhaust system
d) Fuel system
e) Control Panel

IS 13364 (Part 1) and IS 13364 (Part 2) are formulated for Alternator or AC generator part only. Alternator is shown in Fig 2

Fig 2: Alternator

PROJECTED GROWTH OF GENERATOR INDUSTRY IN INDIA :

India's diesel generator market is expected to grow at healthy rate over the period of next 5 years. Factors are - increase in demand for uninterrupted and reliable power supply and increasing growth in the health care industry.

The commercial segment is expected to be the largest market end-user as diesel generators are used to provide most of the electricity from these segments. It is mostly due to their flexible methods like delivering energy on demand that has helped their growth.

Increasing the demand for uninterrupted and reliable power supply is expected to drive the market. A large proportion of the country does not enjoy 24-hour electricity with sporadic electric cuts, which may use diesel generators for powering their houses and businesses.

MANUFACTURERS OF DG SETS AND ALTERNATORS:

Following are the top brands

- Greaves cotton – 5 KVA to 500 KVA
- Ashok Leyland – 5 KVA to 2500 KVA
- Kirloskar Oil Engines Limited – 2 KVA to 5000 KVA
- Cummins Generators – 7.5 KVA to 3750 KVA
- Mahindra Generators – 5 KVA to 2500 KVA
- Supernova Generators – 5 KVA to 3300 KVA
- Sterling Generators – Upto 3000 KVA

Manufacturers of Alternators in India :

Based on desktop research following are the manufacturers of Alternators in India

- Honda Siel Power Products Ltd located in
- Nidec Industrial Automation India Pvt Ltd located in Bangalore
- Stamford Alternators located in Pune
- Meccalte Alternators located in Pune
- Sietz India Pvt Ltd located in Faridabad
- Salasar Engineers located in Delhi

REQUIREMENTS OF INDIAN STANDARD IS 13364 (PART 1) AND (PART 2)

BIS has formulated two standards for AC generators driven by reciprocating internal combustion engines

a) IS 13364 (Part 1) specifies the requirements for Alternators rated from 0.5 KVA to 20 KVA
b) IS 13364 (Part 2) specifies the requirements for Alternators rated from 22.5 KVA to up to and including 1250 KVA

The scope of standard is applicable only for generators driven by Internal combustion engines. Further generators which are operated in Mines, Exposure to dust, Chemical fumes, Fumes of explosives, flammable gases, nuclear radiation, salt air, Exposure to ambient temperature above 40C or below 0C, Operation at speeds other than rated speed are covered in the standard - With suitable modifications for the applications

IS Covers alternators of following ratings

- Voltage rating : 230 V (for single phase), 415 V, 3.3 KV, 6.6 KV, 11 KV, 33 KV, 66 KV, 132 KV, 220 KV, 400 KV (For three phases)
- Power Rating :
  0.5, 1.0, 1,5…..20 KVA (12 Ratings)
  22.5, 25, 27.5, 31, 35, 40 …… 100, 112, 125…. 1250 KVA (36 Ratings)
- Voltage regulation grade : VG1, VG2, VG3 with VG3 being of higher regulation

Following are the tests mentioned in standard

a) Measurement of resistance
b) Insulation Resistance test
c) Phase sequence test (for 3 phase generators only)
d) Regulation tests
e) Measurement of Open circuit characteristics
f) Measurement of Short circuit characteristics
g) High voltage test
h) Efficiency test
i) Temperature rise test
j) Overspeed test
k) Determination of deviation of voltage wave-form from sinusoidal
l) Momentary overload test

Interaction with Manufacturers:

As a part of action research, manufacturers – M/s Honda Siel Power products Limited, M/s Nidec Industrial Automation India Pvt Ltd were contacted.

M/s Honda Siel Power products Limited is manufacturing alternators of rating 1 KVA to 7 KVA.

Firms manufacturing premises is located at Noida.

Firm has explained about the manufacturing infrastructure and test facilities available with them. Firm has reported that currently they are doing testing based on customer requirements. Copy of test report shared by firm is attached at **Annex-A**

Further, firm has confirmed about availability of test facilities for Measurement of resistance, Regulation test, Temperature rise test, Overspeed test, High voltage test, Insulation resistance test, Momentary overload test.

M/s Nidec Industrial Automation India Pvt Ltd is manufacturing alternators of rating from 5 KVA to 3300 KVA. Firm has reported that they are having test facility for all the type and routine test.

Based on interaction with manufacturers it is observed that unavailability of product manual is a hindrance for submitting application. Hence following draft product manual comprising grouping guidelines, test equipments, SIT is prepared for both the Indian Standards IS 13364 (Part 1) and (Part 2) which are annexed at **Annex-B** and **Annex-C**

Interaction with Laboratories :

As of now, there is no BIS recognized laboratory available for testing the product as per IS 13364 (Part 1) and (Part 2). Laboratories which are having test facilities for similar products – CPRI Bangalore, ERDA Vadodara, Delhi test house were contacted.

ERDA Vadodara has confirmed about availability of test facilities for all routine and type tests for alternators of rating upto 20 KVA (ie) IS 13364 (Part 1). Confirmatory email from laboratory is attached at **Annex D**

Other laboratories have not confirmed about availability of test facilities. Considering independent test facilities is available upto 20 KVA, BIS licence can be operative based on factory testing basis for IS 13364 (Part 2). It has been observed that for complete factory testing as per ISS, two mandays are required.

Technological Advancements and Regulatory Norms :

a) Manufacturers are manufacturing the Alternators of rating up to 5000 KVA. However IS scope is restricted up to 1250 KVA, hence scope may be widened to incorporate higher ratings

b) As per Ministry of Environment and Forests notification, maximum permissible sound pressure level for generators up to 1000 KVA shall not exceed 75 dB(A) at 1 metre from enclosed surface. Hence a test requirement/test procedure can be incorporated in Standard regarding maximum permissible sound pressure level. Notification - G.S.R. 371(E):Â dated 17 May 2002 from Ministry of Environment and Forest

While doing this ARP, it has been observed that some of the referred standards mentioned in IS 11364 (Part 1) are withdrawn. Hence it is recommended for following amendments

a) IS 4691 : 1985 - Rotating electrical Machines Part 5 Degrees of protection provided by enclosure for rotating electrical machinery is withdrawn.

   Hence requirements for type of Enclosure is not available

   Recommendation : Reference can be made to IS/IEC 60034(Part 5) - Rotating electrical machines: Part 5 degrees of protection provided by the integral design of rotating electrical

machines (IP Code) – Classification

b) IS 4722 : 1992 – Rotating Electrical Machines is withdrawn.

Hence test method for temperature rise test, high voltage test, Insulation resistance test is not available

Recommendation : Reference can be made to clause 8 of IS 15999 (Part 1) for temperature rise test, clause 9.2 of IS 15999(Part 1) for high voltage test, IS/IEC 60034-27-4 for insulation resistance test

c) IS 4728 : 1975 – Standard has been withdrawn. Hence no requirements for terminal marking

Recommendation : Reference can be made to be IS/IEC 60034 (Part 8) : 2014

d) Clause 13 of ISS mentions limits of vibration is under consideration. Reference can be made to IS 12075 : 2008

e) Test method for regulation not mentioned. Reference can be made to clause 7 of IS 7306 : 1974

Review analysis for IS 13364 (Part 1) and (Part 2) is prepared and attached at **Annex E** and **Annex F**

Conclusion :

a) Non-awareness of manufacturers about the Indian Standard and BIS licence procedures. As interacted with manufacturers and based on the profile of manufacturers, they are not aware of Indian Standard IS 13364 for the product, hence publicity of standard may be provided to all manufacturers

b) Demand for generators with ISI mark not available in market - To create market for ISI marked generators, government departments may be asked to mention IS requirements in their tender documents

c) Independent test facility for Alternators is available only up to 20 KVA

d) Standard may be amended incorporating latest technological developments

ANNEX-A
TEST REPORT SHARED BY FIRM

Honda India Power Products Ltd : Greater Noida
Audit Sample Test Data For Genset : EU70is

Model : EU70is RDT	**Starting** : Self & Recoil						
Mod.Code : Z37A-R0	**Destination** : RDT	**Tested By**	**Checked By**	**Verified By**	**Approved By**		
Country : DOMESTIC	**Lot Size** : 143	**Report No.** : 35/03					
Genrator Type : EEJD	**Sample Qty.** : 2	**Date** : 23.03.2021					
Frame No. : 1314814 TO 1314914		**Result** : Approved ☑		Reject ☐			
1314944 1314980							
1315107 1315111							

Sr. No		Parameters		Units	Specification: 50 HZ ☑ 220V ☐ 230V ☑ 240V ☐ / 60 HZ ☐ 220V ☐	1314823	1314879			Judge-ment
1	Cold Condition	Appear-ance	Dent/Scratch	-	No Abnormality	OK	OK			OK
2			Mark Emblem Location	-	As per spec	OK	OK			OK
3			Switch Movement/ Position	-	Should be OK	OK	OK			OK
4		Dry Weight		kg	123.2 ± 10	123.83	123.89			OK
5		Dimensional Details with handle closed(l x w x h)		mm	1016±40x(680x722)±20	1019x682x720	1018x683x724			OK
6		Dimensional Details with handle open(l x w x h)		mm	1261±40x(680x722)±20	1264x682x720	1264x683x724			OK
7		Starting with Recoil		Nos	3 max	2	2			OK
8		*A. C. Output	N/L Voltage	V	230 ~ 253	243	242.5			OK
9			N/L Frequency	Hz	50.5	50	50			OK
10			R/L Voltage	V	230 ~ 243	233	232.5			OK
11			R/L Frequency	Hz	50± 1	50	50			OK
12			R/L Load Ampere	A	23.9	23.9	23.9			OK
13		CO Check (only for domestic model)		%	4.5	1.85	1.62			OK
14	Hot Condition (After 1.5 hrs run)	A. C. Output	N/L Voltage	V	230 ~ 253	242.5	242.5			OK
15			N/L Frequency	Hz	50.5	50	50			OK
16			R/L Voltage	V	230 ~ 243	232.5	232			OK
17			R/L Frequency	Hz	50± 1	50	50			OK
18			R/L Load Ampere	A	23.9	23.9	23.9			OK
19		Mom. Voltage	Max. Voltage @ N/L	V	230 ~ 253	244	245.0			OK
20			Min. Voltage @ R/L	V	-	230.0	228.0			-
21		Mom. Freq.	Max. Frequency @ N/L	Hz	-	50	50			-
22			Min. Frequency @ R/L	Hz	-	50	50			-
23		Voltage stabilisation Time		Sec.	Less Than 3	2	2			OK
24		Frequency stabilisation Time		Sec.	Less Than 3	0	0			OK
25		Voltage Stabiltiy		%	±1	+ 0.26 - 0.19	+ 0.27 - 0.21			OK
26		Frequency Stabiltiy		Hz	±0.3	0.0	0.0			OK
27		Voltage Regulation (Steady)		%	6.0 Max	4.3	4.5			OK
28		Frequency Regulation (Steady)		%	1.0 Max	0.0	0.0			OK
29		Voltage Regulation (Momentry)		%	10.0 Max	4.9	5.6			OK
30		Frequency Regulation (Momentry)		%	1.0 Max	0.0	0.0			OK
31		* Max. Load	Voltage	V	-	-	-			-
32			Frequency	Hz	-	-	-			-
33			Current	A	-	-	-			-
34		Ambient Dry Bulb Temperature T1(Hot Condition)		°C	Reference Data	29	29			-
35		Ambient Wet Bulb Temperature T2(Hot Condition)		°C		24	24			-
36		Humidity		%		64	64			-
37		Fuel Consumption		Ltr/Hr	2.95+ 5%	2.91	2.96			OK
38		Oil Temp.(4/4 Load) @ 40°C		°C	-	-	-			-
39		Noise Level at(No Load / 3/4 Load / 4/4 Load)		dBA	86	-	-			-
40		High Voltage 1500V for 1 min.		m'A	23	14.63	14.58			OK
41		Insulation resistance 1000V DC for 1 min.		MΩ	Withstand More Than 10	OK	OK			OK
42		Check Oil Leakage		--	Should be no leakage	OK	OK			OK

*** HIPP Own control parameter**

FG-7119-01

ANNEX-B

DRAFT PRODUCT MANUAL OF IS 13364 (PART 1)

AC GENERATORS DRIVEN BY RECIPROCATING INTERNAL COMBUSTION ENGINES - PART 1 – ALTERNATORS RATED UPTO 20 KVA ACCORDING TO IS 13364 (Part 1) : 1992

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

1.	**Product**	:	IS 13364 (PART 1) : 1992
	Title	:	AC GENERATORS DRIVEN BY RECIPROCATING INTERNAL COMBUSTION ENGINES - PART 1 – ALTERNATORS RATED UPTO 20 KVA
	No. of Amendments	:	Nil
2.	**Sampling Guidelines:**		
a)	**Raw material**	:	Nil
b)	**Grouping guidelines**	:	Please refer ANNEX-BA
c)	**Sample Size**	:	One number of AC generator
3.	**List of Test Equipment**	:	Please refer ANNEX-BB.
4.	**Scheme of Inspection and Testing**	:	Please refer ANNEX – BC.
5.	**Possible tests in a day:**	:	Please refer ANNEX – BD.
6.	**Scope of the Licence :**	:	

Licence is granted to use Standard Mark as per IS 13364(Part 1):1992 with the following scope

AC Generators driven by reciprocating internal combustion engines - Part 1 – Alternators upto and including _____ KVA; Voltage rating : _____ V; Voltage regulation grade : _____

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Manak Bhawan, 9, Bahadur Shah Zafar Marg,
New Delhi – 110002

ANNEX BA

GROUPING GUIDELINES

- Voltage rating : 230 V (for single phase), 415 V, 3.3 KV, 6.6 KV, 11 KV, 33 KV, 66 KV, 132 KV, 220 KV, 400 KV (For three phases)
- Power Rating : 0.5, 1, 1.5 … 20 (12 Ratings);
- Voltage regulation grade : VG1, VG2, VG3
- Alternators with rated output from 0.5 KVA to 20 KVA, having same voltage rating are considered as one group. Alternators with lowest and highest rated output in the group shall be tested for covering the entire range of the alternators in that group. If the range consists of more than 10 alternators, one intermediate rating of alternator shall also be tested
- If alternator with highest voltage regulation grade is tested, then lower voltage regulation grade can also be included (ie) if VG3 is tested, then scope may include VG2, VG1 also
- Alternator with each voltage rating shall be tested individually
- The Firm shall declare the varieties of AC generators they intend to cover in the Licence.
- The Scope of Licence may be restricted based on the Manufacturing and Testing capabilities of the Manufacturer.
- During the operation of the Licence, BO shall ensure that all the varieties covered in the Licence are tested in rotation, to the extent possible.

ANNEX BB

LIST OF TEST EQUIPMENT

Major test equipment essentially required to test as per the Indian Standard

Sl. No.	Tests used in with Clause Reference	Test Equipment
1	easurement of Resistance	• Wheatstone Bridge Or • Voltmeter-Ammeter method Or • Digital ohmmeter
2	ase Sequence test – Applicable only for 3 phase	• Phase sequence meter Or • Induction motor with known direction of rotation
3	gulation test, easurement of Open circuit Characteristic, easurement of Short Circuit characteristic, Efficiency test	• Power Analyzer for measurement of Voltage, Current • Short circuiting bars
4	mperature Rise test	• Load Arrangement equivalent to KVA rating of Generator • Ohmmeter
5	verspeed test	• Tachometer • Prime mover capable of rotating the machine at 1.2 times the rated speed
6	igh Voltage test	• HV Tester • Timer or Stop watch
7	sulation Resistance test	• Analog Insulation tester (DC 500 V) • Timer or Stop watch
8	omentary overload test	• Load equivalent to 1.5 times the rated KVA • Timer or Stop watch
9	ounting Dimensions	• PI Tape • Vernier caliper • Micrometer

The above list is indicative only and may not be treated as exhaustive.

ANNEX BC

SCHEME OF INSPECTION AND TESTING

1. LABORATORY – A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

3.1 The manufacturer shall prepare a calibration plan for the test equipment.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. LABELLING AND MARKING – Each Alternator shall be legibly & indelibly marked with the standard mark in addition to the marking requirements as per cl. 18 of IS 13364(Part 1):1992

4. **LEVELS OF CONTROL –** The tests as indicated in column 1 of Table 1 and the levels of control in column 3 of Table 1, shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

5.1 All the production which conforms to the Indian Standard and covered by the licence should be marked with Standard Mark.

6. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1

(1)				(2)	(3)		
Test Details				**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**Levels of Control**		
Cl.	Requirement	Test Methods			No. of Sample	Frequency	Remarks
		Clause	Reference				
10	Earthing	10	IS 13364(Part 1)	R	Each Alternator		-
20.4	Measurement of Resistance	20.4	IS 13364(Part 1)	R			-
20.4	Phase Sequence test	20.4	IS 13364(Part 1)	S	One	Alternators of each type & design manufactured in 6 months	-
15	Regulation test	15	IS 13364(Part 1)	R	Each Alternator		-
20.4	Measurement of Open circuit characteristic	20.4	IS 13364(Part 1)	R			-
20.4	Measurement of Short circuit Characteristic	20.4	IS 13364(Part 1)	R			-
21	High Voltage test	21	IS 13364 (Part 1)	R			-
22	Insulation Resistance test	22	IS 13364 (Part 1)	R			-
11	Temperature rise test	11	IS 13364(Part 1)	S	One	Alternators of each type & design manufactured in 6 months	-
23	Overspeed test	23	IS 13364(Part 1)	S	One		-
15	Efficiency	15	IS 13364 (Part 1)	S	One		
12	Momentary overcurrent test	12	IS 13364(Part 1)	S	One		-
29	Mounting Dimensions	29	IS 13364(Part 1)	S	Alternators of each type & design manufactured at the first instance or whenever there is a change in dimension		-

Note-1: Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note-2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval by BO Head.

ANNEX-BD

POSSIBLE TESTS IN A DAY:

- Measurement of Resistance
- Phase sequence test
- High Voltage test
- Insulation Resistance test
- Regulation test
- Measurement of OCC, SCC
- Overspeed test
- Momentary Overload test
- Efficiency test

ANNEX-C

DRAFT PRODUCT MANUAL OF IS 13364 (PART 2)

AC GENERATORS DRIVEN BY RECIPROCATING INTERNAL COMBUSTION ENGINES - PART 2 – ALTERNATORS RATED ABOVE 20 KVA AND UPTO 1250 KVA ACCORDING TO IS 13364 (Part 2) : 1992

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

1.	**Product**	:	IS 13364 (PART 2) : 1992
	Title	:	AC GENERATORS DRIVEN BY RECIPROCATING INTERNAL COMBUSTION ENGINES - PART 2 – ALTERNATORS RATED ABOVE 20 KVA AND UPTO 1250 KVA
	No. of Amendments	:	1
2.	**Sampling Guidelines:**		
a)	**Raw material**	:	Nil
b)	**Grouping guidelines**	:	Please refer ANNEX – CA
c)	**Sample Size**	:	One number of AC generator
3.	**List of Test Equipment**	:	Please refer ANNEX – CB.
4.	**Scheme of Inspection and Testing**	:	Please refer ANNEX – CC.
5.	**Possible tests in a day:**	:	Please refer ANNEX – CD.
6.	**Scope of the Licence :**	:	

Licence is granted to use Standard Mark as per IS 13364(Part 2):1992 with the following scope

AC Generators driven by reciprocating internal combustion engines - Part 2 – Alternators above 20 KVA upto and including _____ KVA; Voltage rating : _____ V; Voltage regulation grade : _____

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Manak Bhawan, 9, Bahadur Shah Zafar Marg,
New Delhi – 110002

ANNEX CA

GROUPING GUIDELINES

- Voltage rating : 230 V (for single phase), 415 V, 3.3 KV, 6.6 KV, 11 KV, 33 KV, 66 KV, 132 KV, 220 KV, 400 KV (For three phases)
- Power Rating : 22.5, 25, 27.5, 31 … 1250 (36 Ratings);
- Voltage regulation grade : VG1, VG2, VG3
- Alternators with rated output from 22.5 KVA to 1250 KVA, having same voltage rating are considered as one group. Alternators with lowest and highest rated output in the group shall be tested for covering the entire range of the alternators in that group. If the range consists of more than 10 alternators, one intermediate rating of alternator shall also be tested
- If alternator with highest voltage regulation grade is tested, then lower voltage regulation grade can also be included (ie) if VG3 is tested, then scope may include VG2, VG1 also
- Alternator with each voltage rating shall be tested individually
- The Firm shall declare the varieties of AC generators they intend to cover in the Licence.
- The Scope of Licence may be restricted based on the Manufacturing and Testing capabilities of the Manufacturer.
- During the operation of the Licence, BO shall ensure that all the varieties covered in the Licence are tested in rotation, to the extent possible.

ANNEX CB

LIST OF TEST EQUIPMENT

Major test equipment essentially required to test as per the Indian Standard

Sl. No.	Tests used in with Clause Reference	Test Equipment
1	easurement of Resistance	• Wheatstone Bridge Or • Voltmeter-Ammeter method Or • Digital ohmmeter
2	ase Sequence test – Applicable only for 3 phase	• Phase sequence meter Or • Induction motor with known direction of rotation
3	gulation test, easurement of Open circuit Characteristic, easurement of Short Circuit characteristic, Efficiency test	• Power Analyzer for measurement of Voltage, Current • Short circuiting bars
4	mperature Rise test	• Load Arrangement equivalent to KVA rating of Generator • Ohmmeter
5	verspeed test	• Tachometer • Prime mover capable of rotating the machine at 1.2 times the rated speed
6	igh Voltage test	• HV Tester • Timer or Stop watch
7	sulation Resistance test	• Analog Insulation tester (DC 500 V) • Timer or Stop watch
8	omentary overload test	• Load equivalent to 1.5 times the rated KVA • Timer or Stop watch
9	ounting Dimensions	• PI Tape • Vernier caliper • Micrometer

The above list is indicative only and may not be treated as exhaustive.

ANNEX CC

SCHEME OF INSPECTION AND TESTING

2. LABORATORY – A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

3.2 The manufacturer shall prepare a calibration plan for the test equipment.

5. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

6. LABELLING AND MARKING – Each Alternator shall be legibly & indelibly marked with the standard mark in addition to the marking requirements as per cl. 18 of IS 13364(Part 2):1992

7. **LEVELS OF CONTROL –** The tests as indicated in column 1 of Table 1 and the levels of control in column 3 of Table 1, shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

5.1 All the production which conforms to the Indian Standard and covered by the licence should be marked with Standard Mark.

7. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1

(1)				(2)	(3)		
Test Details				**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**Levels of Control**		
Cl.	Requirement	Test Methods			No. of Sample	Frequency	Remarks
		Clause	Reference				
10	Earthing	10	IS 13364(Part 2)	R	Each Alternator		-
20.4	Measurement of Resistance	20.4	IS 13364(Part 2)	R			-
20.4	Phase Sequence test	20.4	IS 13364(Part 2)	S	One	Alternators of each type & design manufactured in 6 months	-
15	Regulation test	15	IS 13364(Part 2)	R	Each Alternator		-
20.4	Measurement of Open circuit characteristic	20.4	IS 13364(Part 2)	R			-
20.4	Measurement of Short circuit Characteristic	20.4	IS 13364(Part 2)	R			-
21	High Voltage test	21	IS 13364 (Part 2)	R			-
22	Insulation Resistance test	22	IS 13364 (Part 2)	R			-
11	Temperature rise test	11	IS 13364(Part 2)	S	One	Alternators of each type & design manufactured in 6 months	-
23	Overspeed test	23	IS 13364(Part 2)	S	One		-
15	Efficiency	15	IS 13364 (Part 2)	S	One		
12	Momentary overcurrent test	12	IS 13364(Part 2)	S	One		-
29	Mounting Dimensions	29	IS 13364(Part 2)	S	Alternators of each type & design manufactured at the first instance or whenever there is a change in dimension		-

Note-1: Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note-2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval by BO Head.

ANNEX-CD

POSSIBLE TESTS IN A DAY:

- Measurement of Resistance
- Phase sequence test
- High Voltage test
- Insulation Resistance test
- Regulation test
- Measurement of OCC, SCC
- Overspeed test
- Momentary Overload test
- Efficiency test

ANNEX-D

Email **Dhinesh Rajagopalan**

RE: Confirmation on availablity of test facility as per IS 13364 (Part 1) and IS 13364 (Part 2)

From : kamlesh kayastha <kamlesh.kayastha@erda.org> Thu, Mar 18, 2021 04:32 PM

Subject : RE: Confirmation on availablity of test facility as per IS 13364 (Part 1) and IS 13364 (Part 2) 1 attachment

To : Dhinesh Rajagopalan <dhinesh.rajagopalan@bis.gov.in>

Cc : nagin parmar <nagin.parmar@erda.org>

Dear Sir,

We can perform testing on alternator as per IS13364-1 up to 20 kVA rating.

Following tests can be performed

a) Measurement of Resistance
b) Phase sequence test
c) Regulation test
d) Measurement of Open circuit characterisitic
e) Measurement of Short circuit characteristic
f) Efficiency test
g) Temperature rise test
h) Overspeed test
j) Insulation resistance test
k) High voltage test
m) Momentary overload test
n) Determination of deviation of voltage waveform

Also can be performed following test
Marking
Terminal marking
Earthing

One sample is required for complete testing
Duration of test: 3 -7 days
Testing charges: will be informed later

Thanks & Regards,

Kamlesh R. Kayastha I Acting HOS – (CRM-BIS) I +91 9978940545

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ANNEX- E

REVIEW ANALYSIS OF IS 13364 (PART 1)

1. **Sectional Committee No. & Title:** ETD 15 (Rotating Machinery)

2. **IS No:** 13364 (Part 1) : 1992

3. **Title:** Ac generators driven by reciprocating internal combustion engines : Part 1 alternators rated up to 20 kVa

4. **Review Analysis**

i) Status of standard(s), if any from which assistance had been drawn in the formulation of this IS.

Standard (No. & Title)	Whether the standard has since been revised	Major changes	Action proposed
4722 : 1992 – Rotating Electrical Machines	4722 is withdrawn. However IS 15999 Part 1, Part 2, specifies ratings and performance, test methods for Rotating electrical machines		

ii) Status of standards referred in the IS

Referred standards (No. & Title)	No. of this standards since revised	Changes that are of affecting the standard under review	Action proposed
IS 5422 : 1979 – Turbine Type Generators	IS 5422 : 1996	Revision of IS 5422 didn't affect IS 13364 (Part 1)	
IS 10242 (Part 3/Sec 1) : 1983 - Specification for electrical installations in ships: Part 3 equipment: Sec 1 generators and motors	No revision of Standard	NA	
IS 12802 : 1989 - Temperature-rise Measurements Of Rotating Electrical Machines	Standard has been withdrawn	Requirements of Temperature rise test for alternators installed above 1000 metres, cooling air temperature more than 40C is changed	Reference can be deleted/ refer to IS 13364(Part 2)

IS 4691 : 1985 - Rotating electrical Machines Part 5 Degrees of protection provided by enclosure for rotating electrical machinery	Standard has been withdrawn	Type of Enclosure – clause 5	Reference can be made to IS/IEC 60034(Part 5) - Rotating electrical machines: Part 5 degrees of protection provided by the integral design of rotating electrical machines (IP Code) - Classification
IS 6362 : 1971- Designation of methods of cooling of rotating electrical machines	Standard has been revised to IS 6362 : 1995	Revision of IS 6362 didn't affect IS 13364 (Part 1)	
IS 12360 : 1988 - Voltage bands for electrical installations including preferred voltages and frequency	No revision of Standard	NA	
IS 4722 : 1992 – Rotating Electrical Machines	Standard has been withdrawn	a) Test method for temperature rise test not available b) Test method for high voltage test not available c) Test method for Insulation resistance test not available	Reference can be made to clause 8 of IS 15999 (Part 1) Reference can be made to clause 9.2 of IS 15999(Part 1) Reference can be made to IS/IEC 60034-27-4
IS 3043 : 1987 – Code for Earthing	Standard has been revised to IS 3043 : 2018	Revision of IS 3043 didn't affect IS 13364 (Part 1)	
IS 4728 : 1975 - Specification for wooden boxes for packaging of apples	Standard has been withdrawn	Affects requirements for terminal marking – clause 17	Reference can be made to be IS/IEC 60034 (Part 8) : 2014

IS 7132 : 1973 - Guide for testing synchronous machines	No revision of Standard	NA
IS 7306 : 1974 - Methods for determining synchronous machine quantities from tests	No revision of Standard	NA
IS 1231 : 1974 - Dimensions and Output Series of Foot Mounted Induction Motors — Frame Numbers 56 to 315 L	Standard has been revised to IS 1231 : 2019	Revision of IS 1231 didn't affect IS 13364 (Part 1)
IS 4889 : 1968 - Methods of determination of efficiency of rotating electrical machines	No revision of Standard	NA

iii) Any other standards available related to the subject & scope of the standard being reviewed (International/regional/other national/association/consortia, etc. or of new or revision of existing Indian Standard)

Standard (No. & Title)	**Provisions that could be relevant while reviewing the IS**	**Action proposed**

iv) Technical comments on the standard received, if any

Source	**Clause of IS**	**Comment**	**Action proposed**
_____Nil _____			

v) Information available on technical developments that have taken place (on product/processes/practices/use or application/testing/input materials, etc)

Source	**Development**	**Relevant clause of the IS under review that is likely to be impacted (Clause & IS No.)**	**Action proposed**
----------Nil----------			

vi) Issues arising out of changes in any related IS or due to formulation of new Indian Standard

Related IS and its Title	**Provision in the IS under review that would be**	**Changes that may be necessary in the**	**Action proposed**

(revised or new)	impacted & the clause no. or addition of new clause/provision	Standards under review	
----------Nil----------			

vii) Any consequential changes to be considered in other IS

Related IS to get impacted	Requirements to be impacted
_____No change_____	

5. Any other observation and Recommendations:

a) As per Central Pollution Control Board guidelines, maximum permissible sound pressure level for generators up to 1000 KVA shall not exceed 75 dB(A) at 1 metre from enclosed surface. Hence a test requirement/test procedure can be incorporated in Standard regarding maximum permissible sound pressure level.

b) Clause 13 of ISS mentions limits of vibration is under consideration. Reference can be made to IS 12075 : 2008

c) Test method for regulation not mentioned. Reference can be made to clause 7 of IS 7306 : 1974

ANNEX-F

REVIEW ANALYSIS OF IS 13364 (PART 2)

1. **Sectional Committee No. & Title:** ETD 15 (Rotating Machinery)

2. **IS No:** 13364 (Part 2) : 1992

3. **Title:** Ac generators driven by reciprocating internal combustion engines : Part 2 alternators rated above 20 KVA and up to 1250 KVA

4. **Review Analysis**

viii) Status of standard(s), if any from which assistance had been drawn in the formulation of this IS.

Standard (No. & Title)	**Whether the standard has since been revised**	**Major changes**	**Action proposed**
IS 4722 : 1992 – Rotating Electrical Machines	IS 4722 is withdrawn. However IS 15999 Part 1, Part 2, specifies ratings and performance, test methods for Rotating electrical machines		

ix) Status of standards referred in the IS

Referred standards (No. & Title)	**IS No. of this standards since revised**	**Changes that are of affecting the standard under review**	**Action proposed**
IS 5422 : 1979 – Turbine Type Generators	IS 5422 : 1996	Revision of IS 5422 didn't affect IS 13364 (Part 1)	
IS 10242 (Part 3/Sec 1) : 1983 - Specification for electrical installations in ships: Part 3 equipment: Sec 1 generators and motors	No revision of Standard	NA	
IS/IEC 60034(Part 5) : 2000 Rotating electrical machines: Part 5 degrees of protection provided by the integral design of rotating electrical machines (IP Code) - Classification	No revision of Standard	NA	

IS 6362 : 1971- Designation of methods of cooling of rotating electrical machines	Standard has been revised to IS 6362 : 1995	Revision of IS 6362 didn't affect IS 13364 (Part 1)
IS 12360 : 1988 - Voltage bands for electrical installations including preferred voltages and frequency	No revision of Standard	NA
IS 15999 (Part 1) : 2016 – Rotating Electrical Machines Part 1 Rating and Performance	No revision of Standard	NA
IS 3043 : 1987 – Code for Earthing	Standard has been revised to IS 3043 : 2018	Revision of IS 3043 didn't affect IS 13364 (Part 1)
IS/IEC 60034 (Part 8) : 2014- Rotating Electrical Machines Part 8 Terminal Markings and Direction of Rotation	No revision of Standard	NA
IS 7132 : 1973 - Guide for testing synchronous machines	No revision of Standard	NA
IS/IEC 60034 (Part 27) : Sec 4 : 2018	No revision of Standard	NA
IS 15999 (Part 4) - Methods for determining synchronous machine quantities from tests	No revision of Standard	NA
IS 1231 : 1974 - Dimensions and Output Series of Foot Mounted Induction Motors — Frame Numbers 56 to 315 L	Standard has been revised to IS 1231 : 2019	Revision of IS 1231 didn't affect IS 13364 (Part 1)
IS 4889 : 1968 - Methods of determination of efficiency of rotating electrical machines	No revision of Standard	NA

x) Any other standards available related to the subject & scope of the standard being reviewed (International/regional/other national/association/consortia, etc. or of new or revision of existing Indian Standard)

Standard (No. & Title)	**Provisions that could be relevant while reviewing the IS**	**Action proposed**

xi) Technical comments on the standard received, if any

Source	Clause of IS	Comment	Action proposed
Nil			

xii) Information available on technical developments that have taken place (on product/processes/practices/use or application/testing/input materials, etc)

Source	Development	Relevant clause of the IS under review that is likely to be impacted (Clause & IS No.)	Action proposed
Manufacturers are manufacturing AC Generators for rating up to 5000 KVA, where as IS 13364 (Part 2) scope restricts AC Generators rating up to 1250 KVA			

xiii) Issues arising out of changes in any related IS or due to formulation of new Indian Standard

Related IS and its Title (revised or new)	Provision in the IS under review that would be impacted & the clause no. or addition of new clause/provision	Changes that may be necessary in the Standards under review	Action proposed
----------Nil----------			

xiv) Any consequential changes to be considered in other IS

Related IS to get impacted	Requirements to be impacted
No change	

5. Any other observation and Recommendations:

d) As per Central Pollution Control Board guidelines, maximum permissible sound pressure level for generators upto 1000 KVA shall not exceed 75 dB(A) at 1 metre from enclosed surface. Hence a test requirement/test procedure can be incorporated in Standard regarding maximum permissible sound pressure level.

e) Manufacturers are manufacturing AC Generators for rating upto 5000 KVA, where as IS 13364 (Part 2) scope restricts AC Generators rating upto 1250 KVA. Hence the standard may reviewed for extending the scope to include higher KVA ratings.

f) Clause 13 of ISS mentions limits of vibration is under consideration. Reference can be made to IS 12075 : 2008

g) Test method for regulation not mentioned in ISS. Reference can be made to clause 7 of IS 7306 : 1974

h) Requirement regarding IP level may be provided. Standard says IP as per IS 60034 (Part 5), but didn't specify which protection to be used