



**PRODUCT MANUAL FOR
PERFORMANCE REQUIREMENTS FOR
CONSTANT SPEED COMPRESSION IGNITION (DIESEL) ENGINES FOR
AGRICULTURAL PURPOSES (upto 19 kW)
ACCORDING TO IS 11170:1985**

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 11170: 1985
	Title	:	PERFORMANCE REQUIREMENTS FOR CONSTANT SPEED COMPRESSION IGNITION (DIESEL) ENGINES FOR AGRICULTURAL PURPOSES (upto 19 kW)
	No. of Amendments	:	5
2.	Sampling Guidelines:		
a)	Raw material	:	Critical Components as per Clause 3.1.1 of IS 11170:1985
b)	Grouping guidelines	:	Each variety of engine shall be tested to cover that particular variety.
c)	Sample Size	:	One engine along with a set of design of the engine and critical components
3.	List of Test Equipment	:	Please refer ANNEX – A
4.	Scheme of Inspection and Testing	:	Please refer ANNEX – B
5.	Possible tests in a day	:	Nil
6.	Scope of the Licence :		Please refer ANNEX – C

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ANNEX A**List of Test Equipment***Major test equipment required to test as per the Indian Standard*

Sl. No.	Tests used in with clause reference	Test equipment
1	Dimensions	a) Go & No-Go Plug Gauges and Snap gauge b) Ring Gauges c) Thread (Plug and Ring) Gauges d) Height gauges and Depth Gauges e) Micrometer (Inside and Outside) f) Vernier Calipers g) V-Block & Magnetic Stand h) Dial Gauges i) Feeler Gauges j) Slip Gauge Set k) Comparator l) Dial Bore Gauges and Master Rings m) Surface Plates
2	In process Control Equipments	a) Hardness Tester b) Spring Tester c) Crack Detector (recommendatory only) d) Nozzle Tester e) Lub-Oil Pump Tester f) Fly-wheel Balancing Equipment(s) g) Cam-Detail Checking Equipment h) Hydraulic Pressure Testing Equipment i) Connecting Rod Alignment & Twist Checking Rig j) Crankshaft Alignment & Pin Parallelism Checking Rig k) Balances (Preferably Self-indicating type) l) High Pressure Fuel Pipe Flushing Equipment m) Torque Wrenches n) Compression Pressure Tester o) Gear Marking Apparatus p) Valve Timing Apparatus q) Arrangement for Checking Bumping Clearance

3	Performance Tests (Clause 4)	<ul style="list-style-type: none"> a) Test bed(s) with suitable dynamometer(s) and loading arrangements b) Pressure Gauges c) Barometer d) Hydrometer / Humidity Indicator (or dry & wet bulb thermometers with humidity chart) e) Tachometer / Stroboscope (instantaneous type) f) Fuel Measuring Apparatus g) Stop Watch h) Thermometers / Pyrometer(s) temperature gauges i) Hygrometer(s) for Specific Gravity of Fuel & Lub Oil. j) Exhaust back pressure gauge / Manometer k) Suitable water circulation arrangements for water cooled engine for rope brake drum (in case of rope brake dynamometer) / Hydraulic dynamometer etc. for maintaining consistency in working temperatures. l) Equipment for governing test m) Equipment for determination of mechanical efficiency (recommendatory) n) Arrangement for determination of calorific value of fuel. o) Apparatus for determination of lubricating oil consumption.
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The above list is indicative only and may not be treated as exhaustive.

ANNEX B**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.

1.1 The manufacturer shall prepare a calibration plan for the test equipment. The following equipment shall be calibrated at a frequency shown against each and records kept.

Sl. No.	TEST EQUIPMENT	FREQUENCY OF CALIBRATION
1	Production gauges, inspection gauges, master gauges	After every 5000 applications or three months, whichever is earlier
2.	Slip gauges, dial gauges, thread gauges and bore gauges	Once in three years
3.	Pressure gauges and pyrometers	To be checked with master gauges once in six months or be replaced whenever not found in working order

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

2.1 The manufacturer shall maintain a system of works inspection at all stages of procurement and manufacture to ensure that the individual working parts of the engine are free from all manufacturing defects.

3. LABELLING AND MARKING – In addition to the requirements of IS 11170:1981, the following shall also be legibly and indelibly marked on the engine:

- (a) Serial number of the engine
- (b) Grades of Oil and Fuel to be used

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. DESIGN, DRAWINGS, DECLARATIONS AND MEASUREMENTS

5.1 The manufacturer shall submit and obtain approval of the design details and drawing of critical components and flywheels of each type and rating of engine from BIS when first offered at the time of GoL and whenever there is any functional change in the engine or its critical components.

5.2 Drawings shall be prepared according to SP 46 (Engineering drawing practice for schools and colleges) and approval obtained from BIS. Drawings shall specify the material, hardness, tolerance, surface finish and all other necessary details.

5.3 Fuel consumption, rated power output, speed, lubricating oil consumption, mechanical efficiency and class of governing shall be declared as per Section 1 of IS 10000 (Part 4) and Clause 4 of IS 11170. Mechanical efficiency, in the absence of specific declaration based on tests shall be assumed to be 80%.

5.4 The technical literature supplied with the engine shall have the following information:

- a) Information given on the data plate (see Clause 3 of SIT).
- b) Accessories supplied with engine.
- c) Operating instructions including operating temperatures and lubricating oil pressure(s).
- d) Servicing schedule and information as per Clause 3 of IS 10000 (Part 11).
- e) Preferably exploded view of engine / sub-assemblies giving all the parts of engine.

5.5 The measuring instruments shall be of accuracy as indicated in IS 10000 (Part 3). The units of measurement shall preferably be as per the IS 10000 (Part 3).

5.6 Test results shall be recorded as per IS 10000 (Part 6) and Clause 2 of SIT. Performance curves shall be plotted in accordance with Appendix D of IS 10000 (Part 6).

5.7 Power of the engine shall be determined during the performance test. Specific Fuel Consumption (SFC) observed during full load condition, during 8 hour rating test as well as during fuel consumption test (loop test) shall not exceed the declared SFC by more than 5%. Measured values shall be compared with the declared values given in the licence applying the adjustment factors and tolerances as per Section 1 of IS 10000 (Part 4) and Clause 4.2 and Clause 4.2.1 of IS 11170.

6. RAW MATERIAL/COMPONENTS INSPECTION

6.1 RAW MATERIAL – All raw materials shall be according to company standards. Manufacturer's test certificates for physical and chemical requirements shall be obtained lot-wise or else it shall be checked lot-wise by the licensee. No further testing is required, if material received is accompanied with Test Certificate or ISI marked.

6.2 COMPONENTS – For all components, either purchased from outside sources or manufactured by licensee/vendor, the following details shall be available:

- a) Complete specification and drawing of each component shall be supplied by the manufacturer to the vendor.
- b) The vendor shall submit test report of all the critical components.
- c) Sampling plan for each component:
 - Critical dimensions of critical components – 100 % (as far as possible)
 - Non-critical dimensions of critical components and other components - Sequential sampling method with an AQL between 1 to 4% (to be adopted by the vendor and supervised by manufacturer's representatives).
- d) Test certificates shall be obtained for physical and chemical properties for each lot of components received by the licensee. The material of Crank shaft, Connecting Rods

and Valves shall also be periodically tested for chemical composition and where possible, for physical properties, as per the declaration in the drawings. Such testing may preferably be done for every lot of the components but at least once in three months at the vendors premises and countersigned by manufacturer's representatives posted in vendor's premises. However, the complete responsibility lies with the manufacturer (licensee).

6.2.1 Various critical components shall be procured from manufacturers whose quality has been established. In case of any change in the material design / size of the critical components, it shall be brought to the notice of BIS and used for the production of ISI marked engines only after the approval by BIS. In case the components are ISI marked no further approval is necessary but intimation to that effect shall be sent to BIS. As far as possible licensee shall ensure that components conform to Indian Standards, wherever exists.

7 INSPECTION OF CASTING

7.1 FOUNDRY – Where a licensee is having his own foundry and is casting important components like Cylinder head, Cylinder block, Cylinder liner and Crank case, the following controls are necessary:

- a) There should be a control on the chemical composition of the melt. The firm must have arrangement of chemical testing. Samples for tensile strength and transverse strength shall be tested in licensee's factory or in an outside laboratory if properties do not match with the licensee. For this purpose, separate test bars shall be cast and tested as per IS 210 and IS 6331 respectively. Chill test is normally carried out during casting.
- b) Equipments for testing like rapid moisture tester, strength tester (green and dry), permeability tester and core hardness tester shall be available for ensuring the use of good quality sand in the moulds.
- c) A metallurgical microscope to check the micro structure of the casting is recommended.
- d) The grade of the cast iron to be used for various components shall be specified. Minimum of grade FG 200 is recommended.

7.2 When castings are obtained from outside sources, test certificates for the physical and chemical properties shall be obtained as per IS 6331. For critical components like cylinder head, cylinder block, cylinder liner and crank case, test bars shall be obtained with each lot and tested at least once in three months or earlier whenever there is change of a manufacturer.

7.3 If castings are not accompanied with test certificates, the test bars received with the lot shall be tested. Test bars, mechanical test, sampling, retests shall be as given in IS 210. Test results shall be as per Table 1 and A-1.1 of IS 6331.

8. 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 Clause	Reference		No. of Sample	Frequency	Remarks
3.1	TYPE TEST						
3.1(a)	Preparation for Tests	3	IS 10000 (Part 5)	R	One	Type tests shall be carried out on engines when first offered and whenever there is any functional change in design of the engine or its critical components or when asked by BIS for specific reasons at any time. In case any of the declared parameters (specific fuel consumption, power, speed etc) is changed, such a change shall constitute significant change and shall entail retype testing of the engines. The engine selected shall be from regular production line and already run for the period and manner declared by the manufacturer. All parts which are essential for engine operation shall also be included.	
3.1(b)	Preliminary Run Test	4	IS 10000 (Part 5)	R			
3.1(c)	Initial Performance Test	2.1	IS 10000 (Part 8)	R			
3.1(d)	Endurance Test	2	IS 10000 (Part 9)	R			
3.1(e)	Final Performance Test	2.2	IS 10000 (Part 8)	R			
3.1(f)	Final Inspection Test	6	IS 10000 (Part 6)	R			
3.1(g)	Lubricating Oil Consumption test	4	IS 10000 (Part 4)	R			

3.5, 4		PERFORMANCE TEST				
3.5	Initial Performance Test	2.1	IS 10000 (Part 8)	R	One engine of each rating (out of every 20 engines or once in a month whichever is earlier)	The engine selected shall be from regular production line and already run for the period and manner declared by manufacturer. All parts which are essential for engine operation shall also be included. During performance tests, sequence of governing test and fuel consumption test may be interchanged depending on the convenience of testing.
4.3	Lubricating Oil Consumption	4	IS 10000 (Part 4)	R		
4.1	Power Determination	2	IS 10000 (Part 4)	R		
4.2	Fuel Consumption Test	3	IS 10000 (Part 4)	R	Each Engine	
4.4	Governing Tests	2	IS 10000 (Part 7)	R	Each Engine	
3.6		ROUTINE PRODUCTION ACCEPTANCE TEST				
3.6.1	Eight Hour Rating Test	2	IS 10000 (Part 4)	R	One engine of each rating (out of every 20 engines or once in a month whichever is earlier).	The engine selected shall be from regular production line. Before starting the test, each engine shall be run for the period and manner declared by the manufacturer and running in period shall include 10% overloading [see Clause 2.1 of IS 10000 (Part 5)] The sequence of these tests may be interchanged depending on the convenience of testing and shall be carried out only after twelve hour rating test. In case any functional change in the design of critical components is made, tests shall be carried out according to IS 10000 (Part 13) only.
3.6.2	Fuel Consumption Test	3	IS 10000 (Part 4)	R		
		2.1.3(b)	IS 10000 (Part 8)			
3.6.3	Governing Tests	2	IS 10000 (Part 7)	R		

OTHER REQUIREMENTS					
3.4	Mechanical Efficiency	6	IS 10000 (Part 4)	R	Once in year for each type, design and rating
3.1.1	Critical Components	3.1.1	IS 11170	S	No further testing is required, if material received is ISI marked. Please see Clause 6.2 of SIT
	Flywheels (a) Size (b) Weight (c) Balancing	As per approved drawings		S	

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

Note- 2: The control unit and levels of control as decided by the Bureau are obligatory to which the licensee shall comply with.

ANNEX C**Scope of the Licence**

Licence is granted to use Standard Mark as per IS 11170:1985 with the following scope:

Name of Product	PERFORMANCE REQUIREMENTS FOR CONSTANT SPEED COMPRESSION IGNITION (DIESEL) ENGINES FOR AGRICULTURAL PURPOSES (upto 19 kW)
Model No	
Rated output in kW	
Type of IS rating	
Rated speed in rev/min	
Specific fuel consumption g/kWh	
Class of governing	
Grades of oil and fuel to be used	
Number of cylinders	
Mechanical efficiency	
Lubrication oil consumption	
Method of cooling	
Type of fuel injection	
No. of stroke	
Type of Engine	