IS 15324 (2003): Shipbuilding - Selection and Testing of Air Starting Systems - Code of Practice [TED 19: Marine Engineering and Safety Aids]

BLANK PAGE

भारतीय मानक

पोत निर्माण—हवा से स्टार्ट होने वाले तन्त्र का चयन एवं परीक्षण—रीति संहिता

Indian Standard

SHIPBUILDING—SELECTION AND TESTING OF AIR STARTING SYSTEMS—CODE OF PRACTICE

ICS 47.020.20

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 2003

Price Group 3

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Marine Engineering and Safety Aids Sectional Committee had been approved by the Transport Engineering Division Council.

A ship is required to be provided with the equipment for starting the main and auxiliary engines so that the necessary initial charge of starting air or initial electric power can be developed on board ship without external aid. This standard covers the requirements for equipment using air starting systems.

While preparing this standard, following have been taken into consideration:

a) The capacity of the air compressors is normally related to the capacity of the air receivers.

b) Safety requirements laid down by the classification societies for the entire air starting system have been taken into account.

c) Efforts have been made by giving all the requirements pertaining to selection and testing of air starting systems in order to facilitate small shipyards to specify the scope of supply to various suppliers.

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SHIPBUILDING — SELECTION AND TESTING OF AIR STARTING SYSTEMS — CODE OF PRACTICE

1 SCOPE

This standard covers selection and testing of following items on board of a ship using compressed air for engine starting:

a) Air receivers,

b) Air compressors, and

c) Pipes and fittings.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
1239	Mild steel tubes, tubulars and other wrought steel fittings:
(Part 1) : 1990	Mild steel tubes (*fifth revision*)
(Part 2) : 1992	Mild steel tubulars and other wrought steel pipe fittings (*fourth revision*)
2825 : 1969	Code for unfired pressure vessels
4310 : 1967	Weldable steel pipe fittings for marine purposes
4693 : 1968	Specification for steel accessories for marine piping systems
5727 : 1981	Glossary of terms relating to compressors and exhausters (*first revision*)
11323 : 1984	Specification for steel gate valves for use in marine pipe work system

3 TERMINOLOGY

For the purpose of this standard the following definitions in addition to those given in IS 5727 shall apply.

3.1 Supplier — The party supplying the machines and equipments. The supplier may or may not be the actual manufacturer of the machines. The term 'supplier' shall also cover any party with whom the supplier places an order for partial compliance.

3.2 Purchaser — The party purchasing the machines and equipments. The term 'purchaser' shall also cover a person or persons authorized in writing by the purchaser to act on his behalf for inspection of the machines.

3.3 Manufacturer — The party manufacturing the machines and equipments. The manufacturer may or may not be the supplier.

4 AIR RECEIVERS

4.1 General

4.1.1 On ships, at least two air receivers shall be provided approximately each of equal capacity, for starting of engines.

4.1.2 Air receivers, intended for starting of engines may also be used for auxiliary services provided sufficient additional capacity for this purpose is available.

4.1.3 The design, manufacture, marking and testing of the air receivers shall be in accordance with IS 2825.

4.1.4 In installations, where the main engine clutches are pneumatically operated, separate air receiver for this purpose shall be provided.

4.2 Total Capacity

4.2.1 The combined capacity of the air receivers intended for starting of reversible engines shall be so determined that it is sufficient to carry out 12 starting manoeuvres and may be approximated by the formula given below and based upon the assumption that initial and final pressures in the air receiver would be 30 kg/cm² and 9 kg/cm² respectively.

$$J = a \times \sqrt[3]{\frac{H}{D}} \times [(z + b \times p_{me} \times n_A) + 0.9].V_h \times c \times d$$

where

J = total capacity of air receivers;

D = bore diameter of the main engine, in cm;

H = stroke of the main engine, in cm;

V_h = swept volume of one cylinder of the main engine, in litres;

z = number of cylinders of main engine;

p_{me} = mean effective pressure of main engine, in kg/cm²;

a = 0.771 for two stroke engines;
= 0.685 for four stroke engines;

b = 0.058 for two stroke engines;
= 0.055 for four stroke engines;

c = 1.0 for single screw installations with engine coupled directly to the shafting;
= 1.5 for single screw installations with two equally sized engines coupled to the shafting through detachable couplings;
= 2.0 for twin-screw installations with each line of shafting having a directly coupled engine;
= 2.0 for twin-screw installations with two equally sized engines connected to a reduction gear box through detachable couplings;

d = 1.0 when p = 30 kg/cm²
If p is less than 30 kg/cm², then

$$d = \frac{0.058\,4}{1-e^{(0.11 - 0.05 \log_e p_{me})}}$$

p = maximum working pressure of air receiver, in kg/cm²;

e = Euler's number (2.718);

n_A = $0.06n_0 + 14$, when $n_0 \leq 1\,000$;

n_A = $0.25n_0 - 176$, when $n_0 > 1\,000$; and

n_0 [Min⁻¹] = rated speed.

4.2.2 For installations with reversing gears or controllable pitch propellers, the starting air capacity may be reduced to 0.5 of the capacity required by **4.2.1** but not less than necessary for 6 manoeuvres.

4.2.3 Separate air capacity for auxiliary engines exceeding that required for main engines need to be provided. However, starting air capacity may be approximated by the formula given in **4.2.1** except that value of c may be changed to as under:

c = 0.30 for one auxiliary engine.
= 0.45 for two auxiliary engines.
= 0.60 for three auxiliary engines.
= 0.75 for four auxiliary engines.

5 COMPRESSORS

5.1 General

5.1.1 At least two air compressors, one of which shall be independent of the main engines, shall be provided on each ship for changing the air receivers within 1h from atmospheric pressure to the pressure sufficient for required number of starts.

5.1.2 Independent air compressors, on ships with engine power less than 150 kW, may be manually operated and connected to a correspondingly small capacity air receiver.

5.2 Capacity

5.2.1 The air quantity, Q in 1/h, air delivered by all the compressors and related to intake conditions shall not be less than:

$$Q = 1.7\,J\,(p - 9)$$

where

J = total capacity of air receivers, in litre and calculated in accordance with **4.2**; and

p = maximum working pressure in the starting air receivers, in kg/cm².

5.2.2 Where main engine driven air compressor is provided, its capacity shall not exceed 50 percent of the capacity stipulated in **5.2.1**.

5.3 Design

5.3.1 The compressor manufacturer shall certify that the design and materials of the air compressor are suitable for marine use, that is, designed to operate in various conditions of trim, heel, vibrations, marine atmosphere, etc, in accordance with the rules of the classification societies.

5.3.2 Grey cast iron shall not be employed in the construction of crankshaft and connecting rods of air compressors of reciprocating type.

5.3.3 Cooler dimension shall be based on a sea water temperature of at least 32°C in case of water cooling and an air temperature of at least 45°C in case of air cooled compressors. Where fresh water cooling is to be proposed, the fresh water inlet temperature shall not exceed 40°C.

5.3.4 Cooler water spaces of the compressors and coolers shall be provided with safety valves or bursting discs so that ample relief is provided in the event of rupture of a tube.

5.3.5 Compressors shall be so designed that the discharge air temperature from the compressor does not exceed 93°C. A small fusible plug or an alarm operating at 121°C shall be provided on the compressor discharge to give warning of excessive air temperature.

5.3.6 High-pressure stage air coolers shall not be located in the compressor jacket cooling water spaces.

5.3.7 Each compressor stage shall be provided with a suitable safety valve which cannot be isolated and shall be capable of preventing the pressure being exceeded by more than 10 percent even if the discharge valve from the compressor is closed.

5.3.8 Each compressor stage shall be fitted with a pressure gauge. The maximum permissible pressure for the stage shall be indicated on the pressure gauge with red marking .

5.3.9 Where one compressor stage consists of several cylinders, each of which can be shut off, each cylinder shall be provided with one safety valve and one pressure gauge.

5.3.10 Thermometers shall be fitted to each stage outlet on compressors having a power consumption of 20 kW and above. The thermometers shall be marked with the maximum permissible temperature.

5.3.11 All compressors shall be fitted with oil and water traps and after cooler behind the final stage.

5.3.12 Water traps, after coolers and air receiver between the stages shall be provided with drains at their lowest points.

5.4 Name Plate

5.4.1 Each compressor shall be fitted with a name plate containing the following information:

a) Indication of source of manufacture,
b) Month and year of manufacture,
c) FAD of compressor,
d) Maximum discharge pressure,
e) Number of revolution per minute,
f) Power consumption, and
g) Number of stages.

5.5 Production Test

The production test is to consist of pre-test procedure and preliminary tests.

5.5.1 *Pre-Test Procedures*

5.5.1.1 *Determination of physical data*

a) Weight of compressor unit complete, wet and dry; and
b) Dimensional survey (overall dimensions).

5.5.1.2 *Hydrostatic test*

5.5.1.3 *Flushing*

The compressor unit to be flushed with hot oil after partial final assembly.

5.5.1.4 *Instrument calibration*

Test instruments are to be checked against standards. The compressor gauge panel instruments to be checked against test instruments.

5.5.1.5 *Electrical equipment*

A functional test is to be carried out on switchgear and protection panel including lubricant oil, air temperature and motor overheat trips.

5.5.2 *Preliminary Tests*

The compressor shall run in accordance with the manufacturer's instructions. The direction of rotation shall be correct.

The compressor shall run at full load for 2h and the following shall be recorded:

a) Motor input,
b) Inlet air pressure and temperature,
c) Discharge air pressure and temperature,
d) Lubricant oil, quantity, pressure and temperature,
e) Cooling water or air pressure and temperature, and
f) Motor temperature rise.

5.6 Shop Trials

5.6.1 Cylinder, cylinder heads and cylinder liner shall be hydrostatically tested to 1.5 times the final compression of the stage in question.

5.6.2 The compressed air containing chambers of the intermediate and after coolers of the air compressor shall be hydrostatically tested to 1.5 times the final compression of the stage in question.

5.6.3 A running test of at least 8 h shall be carried out to prove the following:

a) Capacity,
b) Power consumption,
c) Satisfactory operation, and
d) Operation of instruments and alarms.

During the running test, all the parameters are to be checked/ recorded.

5.6.4 After the test, moving parts of the compressor shall be examined.

6 PIPES AND FITTINGS

6.1 General

6.1.1 The pipes, fittings and accessories shall conform to IS 1239 (Part 1), IS 1239 (Part 2), IS 4310, IS 4693 and IS 11323.

6.1.2 Cast iron shall not be used in the manufacture of compressed air piping and fittings.

6.1.3 Screwed connections (ermeto or keelaring coupling) can be used in the piping.

6.2 Finish

All pipes, fittings and accessories fabricated from mild steel shall be cleaned by pickling, blowing by compressed air and painted from outside.

6.3 Testing

After fabrication, the piping shall be hydrostatically tested to 1.5 times the design pressure.

ANNEX A
(Foreword)
COMMITTEE COMPOSITION

Marine Engineering and Safety Aids Sectional Committee, TED 19

Organization	*Representative(s)*
D.G. Shipping, Mumbai	SHRI B. K. BISWAS (***Chairman***)
	SHRI A. CHATARJEE (*Alternate*)
Alcock Ashdown & Co Ltd, Bhavnagar	SHRI P. MITRA
	SHRI K. J. ROY (*Alternate*)
Bureau Veritas, Mumbai	SHRI P. B. WARRIER
Central Institute of Fisheries Technology, Cochin	DR T. K. SIVASAD
	SHRI K. L. RAMAKRISHANAN (*Alternate*)
Cochin Shipyard Ltd, Cochin	SHRI MATHEW GEORGE
	SHRI K. K. S. NAMBIAR (*Alternate*)
Essar Shipping Ltd, Mumbai	SHRI V. SRINIVASAN
Greaves Cotton & Co Ltd, Mumbai	CAPT S. SOOTA
	SHRI H. L. SHAH (*Alternate*)
Garden Reach Shipbuilders & Engineers Ltd, Kolkata	SHRI S. MAJI
Goa Shipyard Ltd, Goa	SHRI RAGUVEER SINGH
	SHRI V. DAS GUPTA (*Alternate*)
Great Eastern Shipping, Mumbai	SHRI ARUN SHARMA
Hindustan Shipyard Ltd, Visakhapatnam	SHRI A. SESHAGIRI RAO
	SHRI S. LAKSHMINARAYANA (*Alternate*)
Institute of Marine Engineers, Mumbai	SHRI A. R. CHITNIN
	CDR JASBIR SINGH (*Alternate* I)
	SHRI K. R. SACHAR (*Alternate* II)
Institute of Marine Technologists, Mumbai	SHRI DON DYER
	SHRI D. B. IRANI (*Alternate*)
Indian Register of Shipping, Mumbai	SHRI I. N. BOSE
	SHRI U. S. KALGHATGI (*Alternate*)
Kirloskar Oil Engines, Pune	SHRI S. C. SARDESAI
	SHRI P. S. BHAVE (*Alternate*)
Kolkata Port Trust, Kolkata	SHRI S. ROY
	SHRI G. SEN (*Alternate*)
Lloyd's Register of Shipping, Mumbai	SHRI T. K. MITRA
	SHRI S. C. SABHARWAL (*Alternate* I)
	SHRI J. D. GROVER (*Alternate* II)
Ministry of Communication, New Delhi	DR. ASHOK CHANDRA
	SHRI V. V. SINGH (*Alternate*)
Mazagon Dock Ltd, Mumbai	SHRI S. K. MURTHY
	SHRI A. H. SOLANI (*Alternate*)
Ministry of Defence, Directorate of Marine Engineers, New Delhi	CDR A. P. V. THAMPAN
	ASSISTANT DIRECTOR (SYSTEM W) (*Alternate*)
Ministry of Defence, Directorate of Standardization, New Delhi	CAPT P. R. SANGLIKAR
	SHRI A. R. C. VARMA (*Alternate*)
Mather & Platt (India) Ltd, Mumbai	SHRI D. R. BAPAT
	SHRI K. BASHWARAN (*Alternate*)
Mumbai Port Trust, Mumbai	SHRI R. K. KHATTAR
	SHRI S. P. DEOKULIAR (*Alternate*)
Ministry of Surface Transport (Development Wing), New Delhi	SHRI G. P. ROY
	SHRI T. K. DUTTA (*Alternate*)
Ministry of Surface Transport (SBR), New Delhi	DEVELOPMENT ADVISOR (SBR)
	SHRI R. K. SEN (*Alternate*)
Nitin Fire Production System Ltd, Mumbai	SHRI B. R. MALLYA
National Ship Design and Research Centre, Visakhapatnam	DIRECTOR
B.E. Pumps, Kolkata	SHRI CHANDAN DASS GUPTA
Shaparia Dock & Steel Co Pvt Ltd, Mumbai	SHRI C. N. MISTRY
Swastic Rubber Products, Pune	GENERAL MANAGER
The Company of Master Mariners of India, Mumbai	CAPT V. N. AINDLEY
The Indian National Shipowners Association, Mumbai	SHRI M. M. PIPLANI

(*Continued on page* 5)

(*Continued from page* 4)

Organization	*Representative(s)*
The Shipping Corporation of India, Mumbai	SHRI S. K. BHALLA SHRI B. N. ADVANI (*Alternate*)
Varun Shipping, Mumbai	SHRI B. L. MEHTA
Vijay Fire Protection Systems Pvt Ltd, Mumbai	SHRI JATINDERA R. SALOT SHRI HARISH R. SALOT (*Alternate*)
BIS Directorate General	SHRI A. R. GULATI, Director & Head (TED) [Represening Director General (*Ex-officio*)]

Member Secretary
SHRI V. ARUMUGAM
Joint Director (TED), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. TED 19 (169).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	2323 7617, 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054	2337 8499, 2337 8561, 2337 8626, 2337 9120
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 3843, 60 9285
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442, 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093	2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed at Simco Printing Press, Delhi