BUREAU OF INDIAN STANDARDS

INTERNSHIP REPORT 2024

(Period: - 20 May to 19 July)

PREPARED BY:

SOUKARSHA ROY

METALLURGY AND MATERIALS ENGINEERING

INDIAN INSTITUTE OF ENGINEERONG SCIENCE AND TECHNOLOGY, SHIBPUR

PRESENTED TO:

Mr. MAINAK GANTAIT

(SCIENTIST – C & DEPUTY DIRECTOR)

BIS KOLKATA BRANCH OFFICE – I

TABLE OF CONTENTS

INDUSTRY VISIT

UTKARSH INDIA LIMITED, JANGALPUR

Industry Visit:

Utkarsh India Limited is a prominent Indian company known for its diverse range of products and services in the infrastructure, engineering, and construction sectors. Founded in 1987, the company has grown to become a significant player in these industries, with a strong focus on quality, innovation, and customer satisfaction.

Product Range:

1. **Steel Tubes and Pipes**:
    - Manufacturing and supplying high-quality steel tubes and pipes for various applications, including water supply, irrigation, and construction.
2. **Power Transmission and Distribution**:
    - Offering solutions for power transmission and distribution, including manufacturing transmission line towers, substation structures, and monopoles.
3. **Lighting Poles**:
    - Manufacturing various types of lighting poles, including street lighting poles, high mast lighting poles, and decorative poles.

Figure: 1 Welded Pipe

a. Standards they follow

AWS D1.1: Structural Welding Code—Steel

This code contains the requirements for fabricating and erecting welded steel structures. When this code is stipulated in contract documents, conformance with all provisions of the code shall be required, except for those provisions that the Engineer or contract documents specifically modifies or exempts. The following is a summary of the code sections:

1. **General Requirements.** This section contains basic information on the scope and limitations of the code.

2. **Design of Welded Connections**. This section contains requirements for the design of welded connections composed of tubular, or nontubular, product form members.

3. **Prequalification**. This section contains the requirements for exempting a WPS (Welding Procedure Specification) from the qualification requirements of this code.

4. **Qualification.** This section contains the qualification requirements for WPSs and welding personnel (welders, welding operators and tack welders) necessary to perform code work.

5. **Fabrication**. This section contains the requirements for the preparation, assembly and workmanship of welded steel structures.

6**. Inspection**. This section contains criteria for the qualifications and responsibilities of inspectors, acceptance criteria for production welds, and standard procedures for performing visual inspection and NDT (non-destructive testing).

7**. Stud Welding**. This section contains the requirement for the welding of studs to structural steel.

8. Strengthening and Repair of Existing Structures. This section contains basic information pertinent to the welded modification or repair of existing steel structures.

1.1.1 **Limitations**. The code is not intended to be used for the following:

(1) Steels with a minimum specified yield strength greater than 100 ksi (690 MPa)

(2) Steels less than 1/8 in. (3 mm) thick. When base metals thinner than 1/8 in.

(3 mm) thick are to be welded, the requirements of AWS D1.3 should apply. When used in conjunction with AWS D1.3, conformance with the applicable provisions of this code shall be required.

(3) Pressure vessels or pressure piping

(4) Base metals other than carbon or low-alloy steels.

b. Types of Welding

1. High Frequency Induction Welding: High-frequency induction welding (HFRW) is a resistance-welding process in which a high-frequency alternating current is used for heating. The frequencies are 10 to 500 kHz. the heating current is induced in the parts by a high frequency induction coil. The coil does not make physical contact with the work. HFIW are continuous butt welding of the longitudinal seams of metal pipes and tubes.

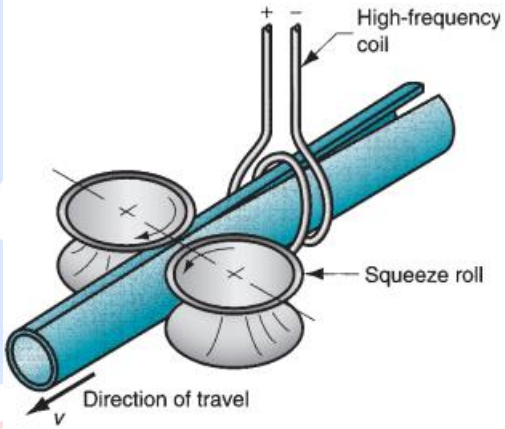


Figure:2 HFIW

2. Electric Resistance Welding: Resistance welding (RW) is a group of fusion-welding processes that uses a combination of heat and pressure to accomplish coalescence, the heat being generated by electrical resistance to current flow at the junction to be welded. The principal components in resistance welding for a resistance spot-welding operation, the most widely used process in the group. The components include work parts to be welded, two opposing electrodes, a means of applying pressure to squeeze the parts between the electrodes, and an AC power supply from which a controlled current can be applied. The operation results in a fused zone between the two parts, called a weld nugget in spot welding.

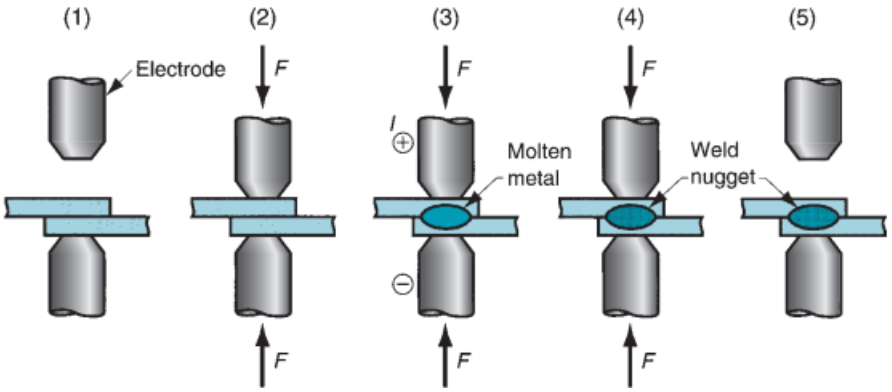


Figure: 3 Electric Resistance Welding

3. Submerged Arc Welding: Submerged arc welding (SAW) is an arc-welding process that uses a continuous, consumable bare wire electrode, and arc shielding is provided by a cover of granular flux. The electrode wire is fed automatically from a coil into the arc. The flux is introduced into the joint slightly ahead of the weld arc by gravity from a hopper. The blanket of granular flux completely submerges the welding operation, preventing sparks, spatter, and radiation that are so hazardous in other AW processes. The portion of the flux closest to the arc is melted, mixing with the molten weld metal to remove impurities and then solidifying on top of the weld joint to form a glasslike slag. The slag and unfused flux granules on top provide good protection from the atmosphere and good thermal insulation for the weld area, resulting in relatively slow cooling and a high-quality weld joint, noted for toughness and ductility.

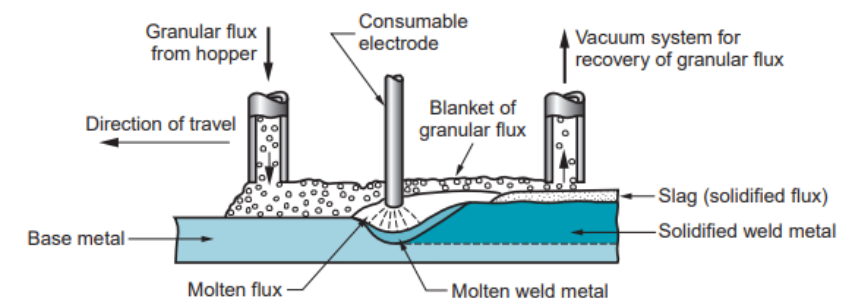


Figure: 4 SAW

4. **Metal Inert Gas Welding**: Metal inert gas welding or Gas metal arc welding (GMAW) is an AW process in which the electrode is a consumable bare metal wire, and shielding is accomplished by flooding the arc with a gas. The bare wire is fed continuously and automatically from a spool through the welding gun. Wire diameters ranging from 0.8 to 6.5 mm (1/32–1/4 in) are used in GMAW, the size depending on the thickness of the parts being joined and the desired deposition rate. Gases used for shielding include inert gases such as

argon and helium, and active gases such as carbon dioxide. Selection of gases (and mixtures of gases) depends on the metal being welded, as well as other factors. Inert gases are used for welding aluminium alloys and stainless steels, while CO2 is commonly used for welding low and medium carbon steels.

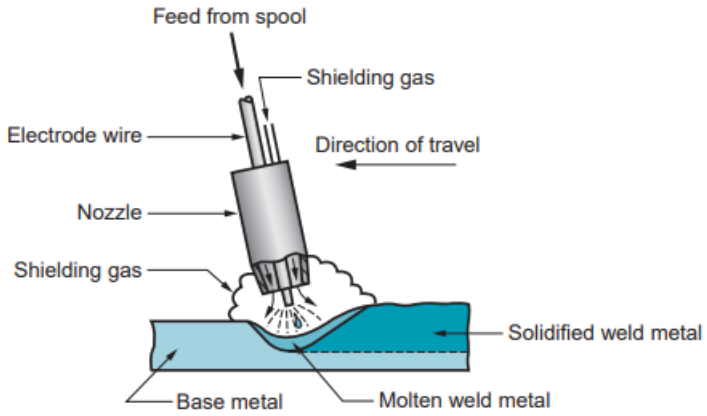


Figure: 5 MIG

5. **Manual Metal Arc Welding**: Manual metal arc welding (MMAW) is an AW process that uses a consumable electrode consisting of a filler metal rod coated with chemicals that provide flux and shielding. The welding stick (MMAW is sometimes called stick welding) is typically 225 to 450mm (9–18 in) long and 2.5 to 9.5 mm (3/32–3/8 in) in diameter. The filler metal used in the rod must be compatible with the metal to be welded, the composition usually being very close to that of the base metal. The coating consists of powdered cellulose (i.e., cotton and wood powders) mixed with oxides, carbonates, and other ingredients, held together by a silicate binder. Metal powders are also sometimes included in the coating to increase the amount of filler metal and to add alloying elements. The heat of the welding process melts the coating to provide a protective atmosphere and slag for the welding operation. It also helps to stabilize the arc and regulate the rate at which the electrode melts. Currents typically used in SMAW range between 30 and 300 A at voltages from 15 to 45 V. Selection of the proper power parameters depends on the metals being welded, electrode type and length, and depth of weld penetration required.

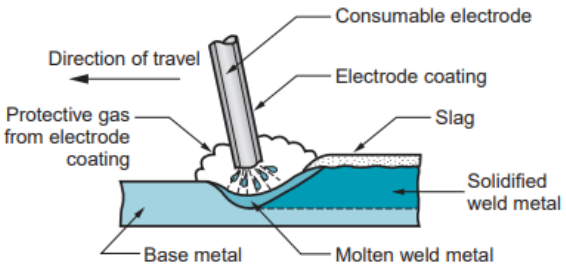


Figure: 6 MMAW

c. Flow Chart of Pipe Manufacturing

- **Raw Material Acquisition**:
  - Procure raw materials such as steel coils or plates.
- **Material Preparation**:
  - Uncoil steel coils and cut steel plates to the required length.
  - Straighten and flatten the material as necessary.
- **Forming**:
  - Feed the prepared material through a series of rollers and forming dies to shape it into a cylindrical pipe.
- **Welding**:
  - Depending on the pipe manufacturing process (e.g., ERW, SAW, etc.), weld the longitudinal seam of the pipe if required.
  - Use appropriate welding techniques and equipment.
- **Sizing**:
  - Pass the welded pipe through sizing rolls to ensure its diameter meets the specified dimensions.
  - Adjust sizing rolls as needed.
- **Cooling and Straightening**:

- **Cooling and Straightening**
- Use straightening equipment to ensure the pipe maintains its desired shape.

 Cutting:

- Cut the pipe into desired lengths using cutting machines.
- Ensure precise cutting according to customer specifications.

 End Finishing:

- Perform end finishing operations such as bevelling, threading, or grooving as required.
- Use appropriate machinery and tools for each finishing operation.

 Quality Control:

- Inspect the pipes for defects, dimensional accuracy, and adherence to quality standards at various stages of production.
- Reject or rework any non-conforming pipes.

 Surface Treatment (if applicable):

- Apply surface treatments such as coating, painting, or galvanizing to protect the pipes from corrosion or enhance their appearance.

 Packaging:

- Bundle the finished pipes according to customer requirements.
- Ensure proper labelling and identification of each bundle.

 Shipping:

- Prepare the packaged pipes for shipment.
- Arrange transportation to deliver the pipes to customers or storage facilities.

d. Test methods they follow

Tensile Testing:

- Tensile testing is a fundamental mechanical test used to determine the mechanical properties of materials, particularly their strength and ductility.
- A specimen of the material is subjected to a controlled tension until it fractures.
- The test measures parameters such as ultimate tensile strength, yield strength, elongation, and reduction in area, providing valuable data on material behaviour under tensile stress.

Flattening Test:

- The flattening test is used to evaluate the ductility and weld quality of pipes or tubes.
- A section of the pipe or tube is flattened using a specialized apparatus until the specified reduction in cross-sectional area is achieved.
- This test helps ensure that the pipe or tube can withstand deformation without cracking or significant loss of mechanical properties.

Bend Test:

- The bend test assesses the ductility, soundness, and weld quality of a material, particularly in welded joints.
- A specimen is bent to a specific angle around a specified radius.
- The test evaluates the material's ability to deform without cracking or failure, providing insights into its ductility and weld integrity.

Hardness Test:

- Hardness testing measures the resistance of a material to indentation or scratching.
- Different hardness testing methods exist, including Rockwell, Brinell, and Vickers tests, each employing specific indenters and load application procedures.
- Hardness testing helps assess material strength, wear resistance, and suitability for various applications.

Chemical Spectrum Analysis:

- Chemical spectrum analysis, often performed using techniques like X-ray fluorescence (XRF) or optical emission spectroscopy (OES), determines the elemental composition of a material.
- In the context of welded samples, chemical analysis can identify any variations in the composition of the base metal and weld metal, as well as detect the presence of any unwanted impurities.

- This analysis helps ensure that the welded joints meet specified composition requirements and can identify potential sources of defects or weaknesses.

Dye Penetrant Test (DPT):

- **Principle**: Detects surface defects in non-porous materials using capillary action.
- **Procedure**: Apply penetrant, let it dwell, remove excess, apply developer, inspect for indications.

Eddy Current Testing (ECT):

- **Principle**: Detects surface and subsurface defects in conductive materials using electromagnetic induction.
- **Procedure**: Pass alternating current through a coil, induce eddy currents, detect changes indicating defects.

Methodology Used for Ascertaining to Good Practises

a) Which standards/SOPs are followed by them for various processes/practices?

For welding operations, Utkarsh India Limited follows standards such as:

- **AWS D1.1:** Structural Welding Code—Steel

b) Does an Indian Standard exist on the subject?

Yes, there are Indian Standards for welding operations, that provide guidelines for welding processes and quality requirements.

1. **IS 814:** Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon Manganese Steel - Specification.
2. **IS 815**: Classification and Coding of Covered Electrodes for Metal Arc Welding of Mild Steel and Low Alloy High Tensile Steel.
3. **IS 816**: Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
4. **IS 818:** Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations.
5. **IS 819:** Code Of Practice for Resistance Spot Welding for Light Assemblies in Mild Steel

c) If an Indian Standard exists, are they aware of the same?

Yes, Utkarsh India Limited is aware of the relevant Indian Standards for welding and adheres to them in their operations.

d) If they are aware and still have not adopted the Indian Standard, what is the reason behind their decision?

The reason is specific client requirements or the necessity to comply with international standards for certain projects.

International and Indian standards are equivalent

e) What is the difference between the standard followed by them and the Indian Standard on the subject?

No difference.

f) Any difficulty in implementing the Indian Standard?

Implementing Indian Standards in welding can present challenges such as:

Ensuring all welders are adequately trained and certified.

Keeping up with updates to the standards.

Meeting stringent quality requirements. Utkarsh India Limited addresses these challenges through continuous training, certification programs, and quality control measures.

g) Is there any legal/statutory requirement to be complied with, which is different from that in the Indian Standard?

The electrode they are using is under mandatory BIS certification as per IS 814.

h) Any changes required in the Indian Standard that can make it amenable to use?

No changes rather it is based on the demand of the purchaser.

i) If an Indian Standard exists and they are not aware of the same, the intern shall inform the same to the firm and enquire whether the requirements in the Indian Standard seem implementable to them.

Utkarsh India Limited is generally aware of relevant Indian Standards. In the rare instance they are not, they would review the standards and assess to implement ability.

j) Is the firm willing to implement the Indian Standard?

Yes, Utkarsh India Limited is committed to implementing Indian Standards to ensure quality, safety, and compliance in their welding operations. However as Indian standard and AWS standard are equivalent, they are guided by the purchaser's requirement.

k) If no, the reasons to be ascertained?

N/A

l) If Indian Standard does not exist, does the firm feel that there is a need to have an Indian Standard?

India Limited would likely advocate for the development of such standards to ensure industry-wide consistency and quality. If an Indian Standard does not exist for a specific welding process or application, Utkarsh

m) If yes, is the firm willing to contribute towards the development of the standard?

Yes, Utkarsh India Limited would be willing to contribute towards the development of new Indian Standards, leveraging their extensive industry experience and expertise in welding operations.

Table 1: Comparison between IS 816 & AWS D1.1

Clause	Indian Standards (IS 816)	AWS D1.1
Clause 3.1`	Mild Steel: All steel for structural members shall be mild steel of weldable quality conforming to IS:226-1974 or IS:2062-1969	The industry uses galvanized steel, also mild steels
Clause 3.2	Electrodes: Electrodes shall confirm to IS 814 (part 1) -1974 and (part 2) -1974	They use Nickel-Cadmium coated steel wire for SAW. For MIG welding, Utkarsh India Limited uses:

		1. **ER70S-6**: This is a common electrode used in MIG welding for carbon steel. It provides good arc stability and low spatter, and it is suitable for welding over mill scale and rust. 2. **ER308L**: This electrode is used for welding stainless steel. It offers low carbon content to prevent carbide precipitation in the weld. For manual metal arc (MMA) welding, also known as stick welding, Utkarsh India Limited uses: 1. **E6013**: This is a versatile electrode used for welding in all positions. It provides a smooth arc and produces a soft, stable arc with low spatter. 2. **E7018**: This electrode is used for welding low to moderate carbon steel. It offers high deposition efficiency and produces a strong, tough weld with low hydrogen content.
Clause 3.3	Filler Wire and Flux: The filler wire and flux combination for submerged arc welding conform to IS 3613-1966	For SAW they used flux. For MIG they use CO2 gas as shielded gas and for arc welding, they don't use any flux or filler material

Clause 4	Drawings and procedure sheets should be prepared in accordance with IS: 696-1972 and IS: 962-1967, using symbols per IS: 813-1961.	Utilizes modern CAD software for precision in design and adherence to specifications. Designs are reviewed and approved by certified engineers to ensure compliance with safety and structural requirements.
Clause 5.1	Allows for two basic types of construction: simple (unrestrained) and rigid frame (continuous).	Follows industry best practices and standards for preparing welding drawings and procedure sheets.
Clause 6.1.1	Details for butt welds must conform to IS: 823-1964 (manual) and IS: 4353-1967 (submerged arc).	They follow the standard procedure for v type for submerged arc welding
Clause 6.1.4.1	Complete penetration butt welds: the effective throat thickness of a complete penetration butt weld shall be taken as the thickness of the thinner part joined.	Joint **Preparation**: The edges of the materials to be joined are prepared with a proper bevel or groove to ensure full penetration. This may include cleaning the surfaces to remove any contaminants like rust, oil, or dirt. Fit-**Up**: Proper alignment and fit-up of the joint are ensured to maintain the specified root gap and prevent misalignment during welding.
Clause 6.1.5	The parent metal is not more than 20 mm thick; the end shall be chipped of cut back to solid metal and welds applied having a width not less than 1 1/2 times the V opening between the parts joined to fill out the ends of the same re-info cement as the faces of the weld	Standard **Pipe Thickness**: These can range from 3 mm to 12 mm or more, depending on the application and the strength required. Heavy-**Wall Pipes**: For applications requiring higher strength and durability, the thickness can go beyond 12 mm.
Clause 7.1.1	Butt welds shall be treated as parent metal with a thickness equal to the throat thickness, and the	Adheres to industry standards for permissible stresses in welds, ensuring structural integrity and safety.

	stresses shall not exceed those permitted in the parent metal (IS 800-1962).	□ Uses advanced computational methods to calculate and verify stress limits. □ Regularly updates stress limits in line with the latest industry research and standards.
Clause 9.1	Where welds are used to connect together the parts of tension members built up from two or more section, the spacing and dimensions of such weld, should be determined by the relative stiffness of the. section, but the spacing of such welds not exceed 105 cm.	For this part the gap between two welds is maintained to less than 100 cm.
Clause 11.3.1	The weld joining the ends of flange plates should be at right angles to the direction of the load.	During manual metal arc welding they hold the flange lates with the high must body in a right angle to the direction of the load
Clause 11.3.2	The ends of the flange plates shall be welded before assembly.	They maintain these things and continue their work after welding.
Clause 13.1	Fillet welding of segregated zones of rolled steel sections should be avoided for fear of unfavourable internal stresses being developed.	They don't do any fillet welding
Clause 15.2.1:	Welding equipment should conform to appropriate Indian Standards and be of adequate capacity. All welding equipment must be maintained in good working order.	Utkarsh India Limited uses advanced welding equipment compliant with Indian Standards, ensuring high capacity and regular maintenance for optimal performance. For 1.2 mm diameter they use 20-22 V voltage and 90-120 A current.
Clause 15.2.3:	The type of electrodes used should be as recommended by the manufacturer for the position of the weld. Electrodes must be stored properly and damaged electrodes should be discarded.	The company uses manufacturer-recommended electrodes suited for specific welding positions and ensures proper storage. Damaged or compromised electrodes are systematically removed

		from the workflow, maintaining high-quality welding standards.
Clause 15.3.2:	Cutting can be done by shearing, cropping, or sawing. Gas cutting is permitted for mild steel and high-tensile steel with special care.	Utkarsh India Limited employs shearing by plasma cutting and gas cutting particularly for mild and galvanized steel. The company uses mechanized cutting tools to ensure accuracy and minimal material stress.
Clause 15.3.4:	During welding and cooling, joints should not be subjected to external forces or vibrations.	The company ensures that welding joints are kept free from external stresses during welding and cooling phases. They employ advanced fixturing and clamping techniques to stabilize the workpieces.
Clause 16.1	: For inspection and testing, refer to IS: 822 standards.	Utkarsh India Limited follows rigorous inspection and testing protocols, in line with IS: 822 standards, to ensure weld quality and safety. Non-destructive testing (NDT) methods like ultrasonic testing and radiographic inspection are commonly used.
Clause 18.1:	Welders should be trained according to IS: 817-1966 and subjected to qualifying tests as per IS: 1181-1967.	Utkarsh India Limited invests in continuous training and certification of their welders, adhering to IS standards. Their welders undergo periodic assessments to maintain and enhance their qualifications and skill levels.
Clause 19.1	Safety requirements and health provisions should be in accordance with IS: 818-1968.	The company prioritizes safety and health by following IS: 818-1968 standards. They implement strict safety protocols, provide personal protective equipment (PPE), and conduct regular safety training sessions.

Recommendation: No recommendation is needed as the industry is follow8ing AWS D1.1 which is equivalent to IS 816 and IS 819.

INDUSTRY VISIT

JINDAL INDIA LIMITED, JANGALPUR

Introduction: Jindal India Limited is a prominent player in the steel and infrastructure industry, known for its high-quality products, advanced manufacturing capabilities, and commitment to sustainability and community development. The company's extensive portfolio and significant market presence make it a key contributor to both the Indian and global markets.

Product Range:

1. **Steel Tubes and Pipes**
2. **Square and Rectangular Hollow Sectional Steel**

Figure: 7 Square Sectional Steel Pipes

Key Features and Capabilities

- **State-of-the-Art Manufacturing Facilities**: Jindal India Limited boasts advanced manufacturing units equipped with the latest technology to ensure high-quality production.
- **Research and Development (R&D)**: The company invests significantly in R&D to innovate and improve its products and processes.

- **Sustainability Initiatives**: Focuses on sustainable practices, including waste management, energy efficiency, and reducing carbon footprint.
-

Certifications and Standards

- **ISO 9001**: Quality management system certification.
- **ISO 14001**: Environmental management system certification.
- **ISO 45001**: Occupational health and safety management system certification.

a. Standards they follow

API 5L: Specifications for Line Pipe

1 PURPOSE AND COVERAGE

The purpose of this specification is to provide standards for pipe suitable for use in conveying gas, water, and oil in both the oil and natural gas industries.

This specification covers seamless and welded steel line pipe. It includes plain-end, threaded-end, and belled-end pipe, as well as through-the-flowline (TFL) pipe and pipe with ends prepared for use with special couplings.

Although the plain-end line pipe meeting this specification is primarily intended for field makeup by circumferential welding, the manufacturer will not assume responsibility for field welding.

2 PRODUCT SPECIFICATION LEVEL (PSL)

This specification establishes requirements for two product specification levels (PSL I and PSL 2). These two PSL designations define different levels of standard technical requirements. PSL 2 has mandatory requirements for carbon equivalent, notch toughness, maximum yield strength, and maximum tensile strength. These and other differences are summarized in Appendix 1.

Requirements that apply to only PSL I or only PSL 2 are so designated. Requirements that are not designated to a specific PSL apply to both PSL I and PSL 2.

The purchaser may add requirements to purchase orders for either PSL I or PSL 2,

3 GRADES

The grades (see the note) covered by this specification are the standard Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70 and X80; and any intermediate grades (grades that are higher than X42, intermediate to two sequential standard grades, and agreed upon by the purchaser and manufacturer).

PSL 1 pipe can be supplied in Grades A25 through X70.

PSL 2 pipe can be supplied in Grades B through X80.

Class II (CI II) steel is rephosphorized and probably has better threading properties than Class I (CI l). Because Class II (CI II) has higher phosphorus content than Class I (CI l), it may be somewhat more difficult to bend.

Pipe manufactured as Grade X60 or higher shall not be substituted for pipe ordered as Grade X52 or lower without purchaser approval.

4 DIMENSIONS

The sizes used herein are dimensionless designations, which are derived from the specified outside diameter as measured in U.S. Customary units, and provide a convenient method of referencing pipe size within the text and tables (but not for order descriptions). Pipe sizes 23/8 and larger are expressed as integers and fractions; pipe sizes smaller than 23/8 are expressed to three decimal places. These sizes replace the "size designation" and the "nominal size designation" used in the previous edition of this specification. Users of this specification who are accustomed to specifying nominal sizes rather than 00 sizes are advised to familiarize themselves with these new size designations used in this specification, especially the usage in Tables 4, 5, and 6A.

PSL 1 pipe can be supplied in sizes ranging from 0.405 through 80.

PSL 2 pipe can be supplied in sizes ranging from 4'/2 through 80.

Dimensional requirements on threads and thread gages, stipulations on gaging practice, gage specifications and certification, as well as instruments and methods for inspection of threads are given in API Standard 5B and are applicable to threaded products covered by this specification.

5 UNITS

U.S. Customary units are used in this specification; SI (metric) units are shown in parentheses in the text and in many tables. The values stated in either U.S. Customary units or SI units are to be regarded separately as standard. The values stated are not necessarily exact equivalents; therefore, each system is to be used independently of the other, without combining values for any specific order item.

Process of pipe making:

1. Roller Leveller

- **Description**: This machine is used to level metal sheets and strips to ensure they are flat and free from any curvature or bend. This is crucial for the consistency and quality of the final product.
- **Application**: Ensures that the steel coils are flat and stress-free before further processing.

2. Decoiling

- **Description**: The process of unrolling steel coils to prepare them for further manufacturing steps. This involves feeding the coiled steel into the production line.
- **Application**: Unrolls HR or slitted coils for subsequent processing.

3. Shear End Welder

- **Description**: This equipment is used to shear the ends of steel strips and weld them together to form a continuous strip for uninterrupted processing.
- **Application**: Ensures continuous production by welding coil ends together.

4. HR / Slitted Coil

- **Description**: Hot Rolled (HR) or slitted coils are the raw materials used for pipe manufacturing. HR coils are hot-rolled steel sheets, and slitted coils are cut from wider coils into narrower strips.
- **Application**: Serves as the initial material for the production of hollow pipes.

5. Slide Trimmer

- **Description**: This machine trims the edges of the steel strip to ensure uniform width and remove any irregularities.
- **Application**: Prepares the strip for accurate and consistent forming.

6. Strip Edge Milling

- **Description**: This process involves milling the edges of the steel strip to ensure they are smooth and have the correct bevel for welding.
- **Application**: Prepares the edges of the strip for high-quality welding.

7. Cage & Roll Forming

- **Description**: The steel strip is formed into a tubular shape using a series of rollers and cages.

- **Application**: Shapes the steel strip into a round, square, or rectangular tube.

8. Spiral Coil Accumulator

- **Description**: A device that stores a large amount of steel strip in a compact coil, ensuring a continuous supply to the forming and welding line.
- **Application**: Maintains continuous production by buffering the strip feed.

9. Weld Seam Annealer

- **Description**: This equipment heats the welded seam to a high temperature and then cools it down, relieving stresses and normalizing the weld area.
- **Application**: Improves the mechanical properties of the weld seam.

10. Weld Roll (Solid State HF Welder)

- **Description**: High-Frequency (HF) welding is used to join the edges of the steel strip together. Solid state HF welders use solid-state technology for efficient welding.
- **Application**: Ensures strong and precise welds for the hollow pipe.

11. Fin Roll Strand

- **Description**: Fin rolls are used to further shape the welded tube and ensure proper size and form.
- **Application**: Refines the shape of the welded tube.

12. Air Cooling

- **Description**: This step involves cooling the welded tube using air to bring it down to ambient temperature.
- **Application**: Solidifies the structure and removes residual heat.

13. Turks Head & Pull-Out Strand

- **Description**: Turks head rolls are used to straighten and square the tube. The pull-out strand provides the necessary tension for the forming process.
- **Application**: Ensures straightness and accurate dimensions of the tube.

14. Fly Cut Off Machine

- **Description**: A high-speed cutting machine that cuts the continuous tube into required lengths without stopping the production line.
- **Application**: Cuts the tube to customer-specified lengths.

15. Water Cooling

- **Description**: Further cooling of the tube using water to ensure it is ready for handling and inspection.
- **Application**: Completes the cooling process for the tube.

16. Sizing Strand

- **Description**: The tube passes through sizing rolls to achieve the final desired dimensions and tolerances.
- **Application**: Ensures the tube meets precise size specifications.

17. Pipe Hydrostatic Tester

- **Description**: This machine tests the pipe for leaks and strength by applying high-pressure water inside the tube.
- **Application**: Ensures the pipe is free from leaks and can withstand the required pressure.

18. End Facing 2

- **Description**: This process involves machining the ends of the pipe to ensure they are smooth and flat.
- **Application**: Prepares the ends for accurate fitting and joining.

19. Weld Ultrasonic Tester

- **Description**: An ultrasonic testing device that inspects the weld seam for internal defects.
- **Application**: Ensures the weld quality and integrity of the pipe.

20. End Facing 1

- **Description**: Similar to End Facing 2, this process ensures the pipe ends are properly machined and finished.
- **Application**: Ensures both ends of the pipe are properly prepared.

21. Marking & Rust Preventive Coating

- **Description**: Pipes are marked for identification and coated with a rust preventive layer to protect them during storage and transportation.
- **Application**: Ensures traceability and protection against corrosion.

22. Customer Inspection Bench

- **Description**: A designated area where customers can inspect the pipes before shipment.
- **Application**: Provides a quality assurance step for customer satisfaction.

23. Works Inspection Bench

- **Description**: Internal inspection area where pipes are inspected for quality control before final approval.
- **Application**: Ensures the pipes meet company standards and specifications.

24. Body Ultrasonic Tester

- **Description**: Ultrasonic testing of the entire pipe body to detect any internal defects or inconsistencies.
- **Application**: Ensures the overall quality and integrity of the pipe.

25. Shipping

- **Description**: The process of packing and dispatching the pipes to customers.
- **Application**: Ensures the pipes are safely transported to their destination.

26. Weighing & Measuring

- **Description**: Final weighing and measurement of the pipes to ensure they meet the specified dimensions and weight.
- **Application**: Provides the final quality check before shipment.

Testing Methods

Hardness Test:

Scope: Determination and verification of the hardness of base metal weld metal and HAZ of HFW pipes.

Preparation of test sample:

A test specimen of size 50*10*T (all in mm) is to be prepared from gas cut sample for Hardness Examination. The same shall be taken transverse to the longitudinal weld direction after removing the gas cut heat affected zone.

Methods for Vickers Hardness Test:

- Set the equipment load to the required level. Set the DWELL time to the required level. Take the calibrated sample and test as per the procedure. Standardize the equipment.
- Take the sample place it on the testing anvil keeping the test surface perpendicular to the indenter axis. Rotate the anvil base till the surface of the sample touches the indenter tip. Now the focusing lens is to be adjusted on the surface of the specimen where the indenter will strike.
- Focus the surface of the sample on the required area of testing. Push back the lens and bring back the indenter on the same spot by clicking the device.
- Push the start button of the Hardness Tester and hold it till the "DWELL TIMER" lights up.
- Release the start button and wait for the dwell time to be completed.
- After completion of DWELL time, bring back the microscope lens to the indenting position.
- Through the view finder find out the diagonal of the indentation on both axis and take the avg. value.
- From the "TABLE OF VICKERS HARDNESS TEST" the Vickers Hardness can be found out by taking the mean diagonal.

Drop Weight Tear Test:

Scope: The scope of this work institution is intended to determine the % of shear area of the fracture generated at the base metal of the pipes**.**

Methods:

- Two transverse specimens are taken from one length of pipe from each heat supplied on the order.
- These specimens are oriented circumferentially from a location 90° from the weld, with the axis of the notch oriented through the pipe wall thickness.
- The specimen shall be flattened, machined to finished size.
- Specimens are tested at 50°F (10°C) or at a lower temperature as specified by the purchaser.
- The velocity of the hammer at impact shall be in the range of 16 to 30 ft/sec (5 to 9 m/sec).

- The specimen shall be inserted in the testing machine so that the notch is lined up with the centreline of the hammer tip on the opposite sides. The notch should be centred between the anvil supports.
- The specimens shall be broken as described herein within a time period of 10 seconds.
- Sample is evaluated by determining the shear area of the fractured surface on the basis of %.

Tensile Test:

Scope: To determine the elongation, yield strength, tensile strength of the specimen.

Preparation of Test Sample:

1. **Base Metal**:
    - Full thickness strip specimens.
    - Transverse specimens cut at 90° to the weld.
2. **Weld Tensile**:
    - Transverse direction with weld at the center.
    - Specimens flattened without heating if required.
3. **Strip Specimens**:
    - Flat face testing grips.
    - 0.500-inch (12.7 mm) round bar specimens taken from weld with pipe size allowance.

Methods:

1. **Grip Check**:
    - Ensure proper grip supply and apply graphite grease to the grip for smooth motion.
2. **Machine Setup**:
    - Select the appropriate grip.
    - Prepare the test piece as per applicable specification.
    - Measure the thickness and width of the test specimen.

Four Point Bend Test

Scope:

Intended for determining sulphide stress corrosion resistance of HFW pipes when put in a corrosive atmosphere.

Preparation of Solution:

- The test solution consists of 5.0% NaCl and 0.5% glacial acetic acid dissolved in 945 g of distilled or de-ionized water.

Test Specimen:

1. **Specimen Dimensions**:
    - Flat strips of metal with uniform rectangular cross-section, 15 mm wide and 115 mm long, 5 mm minimum thickness.
2. **Identification**:
    - Individual specimens inscribed at each end to prevent mix-up.
3. **Surface Preparation**:
    - Surface finish of at least 0.7 µm and a depth of 0.25 mm to remove any worked material.
4. **Mechanical Properties**:
    - Test specimens determined on the same lot from which stress corrosion specimens are obtained.

Charpy Impact Test

Scope:

To determine the Charpy impact value of test specimens of HR coils & pipes.

Preparation of Test Sample:

1. **Sample Size**:
    - Specimens of size 55 mm x 10 mm x 10 mm prepared as per ASTM A 370 / IS: 1499 and related standards.
2. **Sample Orientation**:
    - Specimens are cut from base metal transverse or longitudinal direction at 90° to the weld seam & for weld specimens with the weld in the center.
3. **Sample Preparation**:
    - Discard gas cutting heat-affected zone by suitable means.
    - Prepare three transverse or longitudinal base metal specimens for each test.
4. **Notching**:

- Notch the specimen and ensure the notch in the dummy sample aligns with the notch dimensions as per ASTM A370.
- For HAZ samples, cut the notch 2-4 mm from the weld line or as specified by the customer.

5. **Specimen Checking**:
   - Ensure all specimens are prepared and checked for dimensional tolerances as per ASTM A370.

Methodology Used for Ascertaining to products standards under voluntary certification.

a) Whether the product is being produced according to the concerned Indian Standard or any other standard (international/other country/company standard)?

Ans.IS 3589 and API 5L

b) Whether the product is meant for export or domestic market.

Ans. Only domestic market.

c) In case of production for domestic market, who are their major customers, Government or private institutions or retail consumers including their names and details?

Ans. Private Institution.

d) **Are their customers seeking any kind of certification or compliance to any other standard as a condition of purchase? If yes, the intern should make an attempt to collect the copies of such tender specifications, and details of those standards from the firm.**

No.

e) In case a standard other than Indian Standard is being followed, what is the reason for preferring that standard?

- Trail batch is manufactured by the industry for studying Cost effectiveness of the products.
- Dimensions may be agreed to between the purchaser and manufacturer.

f) Gap areas between the standard being followed and the corresponding Indian Standard.

Ans. In Indian standard the thickness that is mentioned is up to less than 2 mm, but in their standard the thickness of greater than 2 mm is included. Cross section 400*400 but in Indian standard it is up to 180*180 (for square section) and 200*100 but in IS it is 500*300

g) How is the marking and labelling being done on such products? In what manner it deviates from the requirements given in Indian Standards?

Ans. MarnIn the marking portion the company logo, grades, dimensions & size and their code is marked

h) In case third party certification by some other body against the adopted standard has been obtained, what are the reasons for selecting that body and in what ways their process is different from BIS Certification process?

Ans. DNB, TUV, EIL, MCON, IOCL, EDLIPAC, VELOSI, VCS they come for inspection.

The difference is the testing part they do in the industry's lab not any other lab.

i) Suggestions for changes that may be required in the standard for making it amenable?

Ans. Mentioned in Table 2

j) In case Indian Standard is being followed, what is the reason for not opting for BIS certification?

- Trail batch is manufactured by the industry
- They have stopped manufacturing of hollow steel
- Dimensions may be agreed to between the purchaser and manufacturer.

k) What changes in the BIS certification process would encourage them to obtain BIS certification voluntarily?

Ans. Licence may be granted on factory testing based.

Table 2: Comparison between IS 18573 & API 5L

Clause	Indian Standard (IS 18573)	API 5L

Clause 3	TYPES AND GRADES Types and grade of the cold formed square and rectangular hollow section for mechanical, general engineering and decorative purposes shall be based on the process of manufacture and minimum yield stress, in MPa.		YST 250, YST 210, YST 240, YST 310
	Welded (WT) Square and rectangular sections Electric resistance welded or high frequency induction welded (ERW or HFIW) sections	YSt 160, YSt 210, YSt 240, YSt 310 and YSt 355	
Clause 4.1	The ladle analysis of steel shall not show either Sulphur or phosphorus more than 0.040 percent, when carried out either by the method specified in relevant parts of IS 228 or any other established instrumental/chemical method. In case of dispute the method given in relevant parts of IS 228 shall be the referee method.		
Clause 4.2	Unless specified by the purchaser, hot-rolled or cold-rolled steel sheets or strips of any suitable grade to IS 10748, IS 513, or any other equivalent specification may be used for manufacturing the square and rectangular section of above-mentioned grades.		No such information is mentioned.
Clause 5	SUPPLY OF MATERIAL General requirements relating to the supply of square and rectangular sections for mechanical, general engineering and decorative purposes shall conform to IS 1387.		No such information is mentioned.
Clause 6	WORKMANSHIP All sections shall be free from harmful defects, reasonably smooth and free from loose scale and		No such information is mentioned.

	rust. Surface imperfections such as handling marks, light roll or die marks or shallow pits are not considered defects provided that the imperfections are removable within the specified limits of wall thickness. Welded sections shall be free of protruding metal on the outside surface of the weld seam. Unless otherwise specified, ends shall be cut square.	
Clause 7	STRAIGHTNESS The square and rectangular sections shall be supplied in mill straightened or finished condition. Unless otherwise tolerances are agreed to between the purchaser and the manufacturer, section shall not deviate from straightness by more than 1/200 of the length, measured at the Centre of that length for mill straightened condition and 1/600 of the length at the Centre of that length for finished condition.	Straightness The tubes shall be supplied either in finish or mill straightened condition as agreed to between the purchaser and the manufacturer for which maximum deviation from straightness shall as under 1/600th of length at the centre of length for finished straightened condition. For tubes in mill straightened condition l/200th of any length at the centre of the length.
Clause 8	For the purpose of the standard, the weights are calculated on the basis that steel weighs 0.785 kg/cm² per meter run. For calculating cross sectional area and weight per unit length, corner radii have been taken into consideration	No such information is mentioned.
Clause 9	LENGTH Unless specified by the purchaser, square and rectangular carbon steel section shall be supplied in random lengths from 4 m to 7 m. Wherever the exact length requirement is there, it will be subject to agreement between the manufacturer and the purchaser.	No such information is mentioned.
Clause 10	DIMENSIONS AND PROPERTIES	No such information is mentioned.

	Recommendations on section size and thickness are given in Table 3 and Table 4. However, any other section size and thickness as agreed to between the manufacturer and the purchaser may be supplied. The design properties of these square and rectangular carbon steel sections are given in Table 3 and Table 4 for guidance only.	
Clause 11.1	The sections shall be supplied either in finish straightened or mill straightened condition for which maximum deviation from straightness shall be as given in 7. All external dimensions shall be measured at a distance from the end of the hollow section of not less than B for square sections or H for rectangular sections, with a minimum of 100 mm	The tubes shall be supplied either in finish straightened or mill straightened condition as agreed to between the purchaser and the manufacturer for which maximum deviation from straightness shall be as per 14.1, 18.1. All external dimensions shall be measured at a distance from the end of the hollow section of not less than B for square sections or H for rectangular sections, with a minimum of 100 mm.
Clause 11.2	Outside Dimension For square or rectangular hollow sections, outside dimensions, B and H, shall be measured. A vernier caliper gauge or other suitable device may be used at the discretion of the manufacturer. Dimensions B and H shall be measured at a position within 5 mm (from where this requirement has extracted) from the start of the external corner profile as shown in Fig. 1. All Dimensions in millimeters. This dimension is a maximum when measuring B or H and a minimum when measuring T.	For square or rectangular hollow sections, outside dimensions, B & H, shall be measured. A vernier calliper gauge or other suitable device may be used at the discretion of the manufacturer. Dimensions B and H shall be measured at a position within 5 mm from the start of the external corner profile as shown in Fig. 1. All Dimensions in millimeters. This dimension is a maximum

		when measuring B or H and a minimum when measuring T.
Clause 11.3	Thickness The thickness, T, shall be measured at a position of not less than 2 T from the weld. The limiting cross-sectional positions for measuring the thickness of square and rectangular hollow sections are shown in Fig. 1.	The thickness, T, shall be measured at a position of not less than 2T from the weld. The limiting cross-sectional positions for measuring the thickness of square and rectangular hollow sections are shown in Figure 1.
Clause 11.4	Concavity and Convexity The concavity, x1, or the convexity, x2, of the sides of a square or rectangular hollow section shall be measured as shown in Fig. 2. The percentage concavity or convexity shall be calculated using the following: $x1$ B × 100; $x2$ B × 100; $x1$ H × 100; $x2$ H × 100; where B and H are the lengths of the sides containing the concavity, x1, or the convexity, x2.	The concavity, x1, or the convexity, x2, of the sides of a square or rectangular hollow section shall be measured as shown in Fig. 2. The percentage concavity or convexity shall be calculated using the following: 1212 100; 100; 100; 100 xx xx BBHH ×××× where B and H are the lengths of the sides containing the concavity, x1, or the convexity, x2.
Clause 11.5	Squareness of Sides The deviation from squareness of the sides of a square or rectangular hollow section is defined as the difference between 90° and θ as shown in Fig. 3.	The deviation from squareness of the sides of a square or rectangular hollow section is defined as the difference between 90° and r as shown in Fig. 3.
Clause 11.6	External Corner Radius The external corner radius, R of a square or rectangular hollow section (Fig. 4) is measured by using radius gauge or another suitable device.	The external corner radius, R of a square or rectangular hollow section (Fig. 4) is measured by using radius gauge or other suitable device.

Clause 11.7	Straightness and Twist The total twist, V, in a square or rectangular hollow section shall be determined in accordance with any of the following methods, at the discretion of the manufacturer. Place the hollow section on a horizontal surface with one side at one end pressed flat against the surface. At the opposite end of the hollow section, determine the difference, V, in the height of the two lower corners from a horizontal surface (see Fig. 5). Measure V with a spirit level or scale or micrometer (screw) gauge or another suitable device. The reference length of the spirit level shall be the distance between the intersection of the flat sides and the external corner profile (see Fig. 6). V is the difference between the values, V1 (see Fig. 6), measured at each end of the section.	The total twist, V, in a square or rectangular hollow section shall be determined in accordance with any of the following methods, at the discretion of the manufacturer. Place the hollow section on a horizontal surface with one side at one end pressed flat against the surface. At the opposite end of the hollow section, determine the difference, V, in the height of the two lower corners from a horizontal surface (see Fig. 5). Measure V with a spirit level and micrometer (screw) gauge or other suitable device. The reference length of the spirit level shall be the distance between the intersection of the flat sides and the external corner profile (see Fig. 6). V is the difference between the values, V1 (see Fig. 6), measured at each end of the section
Clause 12	DIMENSION TOLERANCES The square and rectangular hollow section shall conform to the following tolerances. a) Thickness — The tolerance on thickness excluding the weld shall be ± 10 percent; b) Outside dimensions — The tolerances for the outside dimensions of the square and rectangular	Thickness for all sizes 1) Welded tubes + 7.5 Percent 2) Seamless tubes + 12.5 Percent b) Outside dimensions + 1 percent of length of the side to be measured with a minimum tolerance of + 0.5 mm

	sections shall be ± 1 percent of length of the side to be measured with a minimum of ± 0.50 mm; c) Squareness of corner — The squareness of the corner shall be 90° ± 2°; d) Radii of corners — The radii of corners shall not be more than 3 t where t is the thickness of section; e) Exact length — The tolerances on the exact length shall not be more than + 6 mm or as agreed between the manufacturer and purchaser; f) Random length — Square and Rectangular carbon steel section shall be supplied in random lengths from 4 m to 7 m. Whereas, a stringent tolerance may be agreed between the manufacturer and the purchaser; g) Concavity/convexity — The tolerance on concavity/convexity shall not be more than 1 percent of the size; h) Twist — 2 mm plus 0.5 mm per meter length; and i) Weight — The tolerance on weight shall be within ± 10 percent.	c) Weight + 10 Percent 1) On individual length – 8 Percent 2) On lots of 10 + 7 Percent tons, Min d) Squareness of corner 90°+ 2° e) Radii of corners— 3t max where t is Outside the thickness of section f) Length 1) Exact length + 6 mm 2) Random length This may be obtained by arrangement between purchaser and manufacturer g) Concavity/Convexity 1 percent of the size h) Twist 2 mm plus 0.5 mm/m measured in accordance with the figure
Clause 13	SURFACE PROTECTION 13.1 Unless otherwise specified square and rectangular section shall be supplied uncoated or with manufacturer's standard mill protective coating. 13.2 When square and rectangular section are to be hot dip galvanized, they shall first be thoroughly descaled and then dipped in a bath of molten zinc at a temperature suitable to produce a complete and uniformly adherent coating of zinc. The zinc used for coating shall conform to IS 209 or IS 13229. The galvanizing shall be capable of passing the test specified in IS 2633. Specific	Hollow sections may be varnished, painted or oiled externally or may be galvanized as agreed between the purchaser and manufacturer. In case of galvanizing, the mass of zinc coating shall be as per the agreement between the manufacturer and purchaser. Pre galvanized sheet may be used for rolling hollow sections

	requirement for galvanizing and mass of coating shall be subject to mutual agreement between the purchaser and the manufacturer or as per the manufacturer's standard.	if so, agreed between the purchaser and manufacturer.
Clause14.1	TESTING The manufacturer shall carry out the specified tests applicable to square and rectangular carbon steel sections and shall, if required by the purchaser, supply a certificate stating that hollow sections comply with the specified requirements. When the purchaser desires such certificate, this shall be stated in the enquiry and order.	No such information is mentioned.
Clause 14.2	When the purchaser requires additional tests related to his order, such tests shall be subject to agreement between the purchaser and the manufacturer.	No such information is mentioned.
Clause 15.1	TENSILE TEST Tensile test shall be carried out in accordance with IS 1608 on one of the following at the manufacturers' option: a) A length cut from the end of the selected section, (the ends being plugged for grips or flattened where necessary); and b) A longitudinal strip cut from the section and tested. The test piece should be cut from the side which does not contain weld.	One tensile test shall be carried out for each batch of 500 hollow sections. When tested in accordance with IS 1608, the tensile properties shall be as shown in Table 3Elongation on a gauge length of 5.65 A (where, A is the cross-sectional area of test specimen).
Clause 16.1	RETESTS Should any one of the test pieces selected fail to pass the test specified, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material shall be deemed to comply with the requirements of the test. Should the test pieces from either of these additional samples fail, the material represented by the test	Should any one of the test pieces selected fail to pass the test specified under 15, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material shall be deemed to

	samples shall be deemed as not complying with this standard.	comply with the requirements of the test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be deemed as not complying with this standard.
Clause 17.1	SAMPLING FOR SECTIONS Should any one of the test pieces selected fail to pass the test specified, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material shall be deemed to comply with the requirements of the test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be deemed as not complying with this standard.	No such information is mentioned.
Clause 17.2	Sampling and Criterion for Conformity Unless otherwise agreed to between the manufacturer and the purchaser the procedure for sampling of sections for various tests and criteria for conformity, one test per 1000 nos. to be done.	The section shall be supplied in as welded condition. The section may also be stress relieved, annealed or normalized as agreed between manufacturer and purchaser.
Clause 18.1	MARKING Manufacturer name/logo/trade-mark shall be embossed or marked on each hollow section. Each section shall have grade and size designation suitably marked on it. Alternatively, a label containing the particulars may be attached to a bundle of sections.	Manufacturer name/Logo/Trade-mark shall be embossed on each hollow section. Each hollow section shall have size designation suitably marked on it. Alternatively, a label containing the particulars may be attached to a bundle of hollow sections.

		Other particulars required by the purchaser may be suitably-marked as mutually agreed.

Recommendation: The recommendation is mentioned in the table.

INDUSTRY VISIT

SUVIK OVERSEAS PRIVATE LIMITED, JAGADISHPUR

Introduction

Suvik Overseas Private Limited, an ISO 9001:2015 certified is the largest and leading manufacturer of safety pins in India. With a rich heritage spanning over 54 years of experience and established since 2006, we have been dedicated to providing **high-quality, reliable and innovative safety pin** solutions for a wide range of industries.

Product Range: 'M' type safety Pins of sizes 2/0, 0, 1, 2, 4.

Figure: 8 'M' type Safety Pins

Manufacturing processes

Wire Preparation:

- **Material Selection**: High-quality stainless steel or brass wire is chosen for its strength and corrosion resistance.
- **Wire Drawing**: The selected wire is drawn through a series of progressively smaller dies to reduce its diameter to the desired size. This process also increases the wire's strength.

Cutting:

- The wire is cut into specific lengths suitable for the size of the safety pins being produced. This is usually done using automated cutting machines for precision and efficiency.

Forming the Coil:

- The cut wire is then fed into a machine that forms the coil or spring of the safety pin. This part is crucial as it provides the tension needed to keep the pin closed securely. The machine bends the wire into a coil shape and ensures it has the correct tension.

Shaping the Pin:

- **Point Formation**: One end of the wire is sharpened to form the pin point. This is done using grinding machines that create a smooth, sharp point.
- **Head Formation**: The other end of the wire is shaped into the head of the pin. This head serves as the holding area when the pin is closed. The head can be a simple loop or a more complex shape, depending on the design.

 Assembly:

- The coiled and shaped wire is then assembled into the final safety pin shape. Automated machines bend the wire into the characteristic safety pin shape, ensuring the pin point is securely held by the clasp.

 Finishing:

- **Polishing**: The assembled safety pins are polished to remove any burrs or rough edges, ensuring they are smooth and safe to use.
- **Plating**: Depending on the material, the pins may undergo electroplating with materials like nickel or zinc to enhance their corrosion resistance and appearance.

 Quality Control:

- Each batch of safety pins undergoes strict quality control checks to ensure they meet the required standards. This includes checking the sharpness of the pin point, the strength of the spring, and the overall dimensions and appearance of the pins.

 Packaging:

- The finished safety pins are counted and packaged for distribution. Packaging can vary from bulk packaging for industrial use to small, consumer-friendly packages for retail.

Methodology Used for Ascertaining to products standards under voluntary certification.

a) Whether the product is being produced according to the concerned Indian Standard or any other standard (international/other country/company standard)?

Ans. Yes, Indian Standard

b) Whether the product is meant for export or domestic market.

Ans. Only domestic market.

c) In case of production for domestic market, who are their major customers, Government or private institutions or retail consumers including their names and details?

Ans. Retail consumers

d) Are their customers seeking any kind of certification or compliance to any other standard as a condition of purchase? If yes, the intern should make an attempt to collect the copies of such tender specifications, and details of those standards from the firm.

No.

e) In case a standard other than Indian Standard is being followed, what is the reason for preferring that standard?

Ans. N/A

f) Gap areas between the standard being followed and the corresponding Indian Standard.

Ans.

g) How is the marking and labelling being done on such products? In what manner it deviates from the requirements given in Indian Standards?

Ans. In the marking portion the company logo, grades, dimensions & size and their code is marked

h) In case third party certification by some other body against the adopted standard has been obtained, what are the reasons for selecting that body and in what ways their process is different from BIS Certification process?

Ans. No third-party certification is done.

i) Suggestions for changes that may be required in the standard for making it amenable?

Ans. No suggestion

j) In case Indian Standard is being followed, what is the reason for not opting for BIS certification?

Ans. N/A

k) What changes in the BIS certification process would encourage them to obtain BIS certification voluntarily?

Ans.

N/A

INDUSTRY VISIT

RBA EXPORT PRIVATE LIMITED, ULUBERIA

Introduction

RBA Export Private Limited specializes in the export and import of a wide range of products. The company is known for its extensive network and expertise in handling various commodities, ensuring they meet international standards and customer requirements.

Product Range: Ductile Iron & Grey Cast Iron Pipe Fittings

Figure: 9 Ductile Pipe Fittings

Key Features and Capabilities

- **Global Network**: RBA Export Private Limited has a strong global presence with established relationships with suppliers and customers across various countries.
- **Quality Control**: The company emphasizes strict quality control measures to ensure all exported and imported products meet the required standards.
- **Sustainability**: Focuses on sustainable practices and ethical sourcing to minimize environmental impact and support responsible trade.

Certifications and Standards

- **ISO Certification**: Likely holds ISO certifications for quality management and possibly for environmental management, depending on their operational focus.

DIN EN 1563: Spheroidal graphite cast irons

This European Standard defines the grades and the corresponding requirements for spheroidal graphite cast irons.

This European Standard specifies 2 groups of spheroidal graphite cast iron grades by a classification based on mechanical properties measured on machined test pieces prepared from cast samples. The first group deals with ferritic to pearlitic grades. The second group deals with solid-solution strengthened ferritic grades.

This European Standard does not cover technical delivery conditions for iron castings (see EN 1559-1and EN 1559-3).

This European Standard does not cover all aspects of:

- Aus-ferritic spheroidal graphite cast irons which are specified in EN 1564;
- low alloyed ferritic spheroidal graphite cast irons which are specified in EN 16124;
- austenitic cast irons which are specified in EN 13835;
- spheroidal graphite cast irons used for pipes, fittings and their joints which are the subject of EN 545, EN 598 and EN 969;
- the grades of spheroidal graphite cast iron as specified in EN 545 which are used for products such as industrial valves, non-industrial manually operated shut-off valves and flanges and their joints, which are the subject of the applicable European product standards.

ASTM a48: Standard Specification for Gray Iron Castings

1.1 This specification covers grey iron castings intended for general engineering use where tensile strength is a major consideration. Castings are classified on the basis of the tensile strength of the iron in separately cast test bars.

1.1.1 This specification subordinate's chemical composition to tensile strength.

1.2 Castings produced to this specification are graded on the basis of minimum tensile strength obtained in special test coupons designed to standardize cooling rate. The tensile strength developed in certain casting sections may vary from test coupon values (see X1.2).

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification

Manufacturing processes

1. Raw Material Selection and Preparation

- **Material Selection**: Choose high-quality raw materials, including pig iron, scrap steel, and alloys such as silicon, magnesium, and copper.
- **Material Inspection**: Conduct thorough inspections to ensure raw materials meet the required standards.
- **Storage**: Properly store materials to prevent contamination.

2. Melting

- **Furnace Charging**: Load the selected raw materials into a furnace, typically an electric induction furnace.
- **Melting Process**: Melt the materials at temperatures between 1350-1500°C. Monitor and control the temperature and composition throughout the process.
- **Alloying**: Add necessary alloying elements to achieve the desired chemical composition.

3. Treatment

- **Desulfurization**: Remove sulphur from the molten metal to improve ductility.
- **Magnesium Treatment**: Add magnesium to the molten iron to transform graphite flakes into spherical nodules, ensuring ductility. This is typically done using methods like the sandwich process, plunging, or cored wire feeding.

4. Inoculation

- **Inoculant Addition**: Add inoculants (such as ferrosilicon) to the molten iron just before pouring to control the solidification structure and improve mechanical properties.
- **Stirring**: Properly stir the molten metal to ensure even distribution of inoculants.

5. Molding

- **Mold Preparation**: Use sand molds, which are commonly prepared using patterns to shape the desired casting.

- **Mold Coating**: Apply coatings to the mold to improve surface finish and prevent reactions between the molten iron and the mold.

6. Pouring

- **Ladle Transfer**: Transfer the treated molten iron into pouring ladles.
- **Pouring**: Pour the molten iron into prepared molds under controlled conditions to avoid turbulence and gas entrapment.
- **Pouring Temperature**: 1300-1350°C (2372-2462°F).

Figure: 10 Pouring

7. Cooling and Solidification

- **Controlled Cooling**: Allow the molten iron to solidify in the molds. Controlled cooling rates are critical to achieve the desired microstructure and mechanical properties.

8. Shakeout

- **Mold Breakage**: Break the molds to remove the solidified castings.
- **Casting Removal**: Extract the castings from the sand molds.

9. Cleaning and Fettling

- **Surface Cleaning**: Remove any sand, scale, or other residues from the castings using processes like shot blasting or grinding.
- **Fettling**: Trim excess material, such as gates, risers, and flash, from the castings.

Figure: 11 Shakeout Process

10**. Heat Treatment**

- **Stress Relieving**: Heat treat the castings to relieve internal stresses.
- **Austempering**: Perform heat treatment processes such as austempering to enhance mechanical properties.

11. Machining

- **Rough Machining**: Perform initial machining operations to achieve approximate dimensions.
- **Finish Machining**: Conduct precision machining to achieve the final specifications and tolerances.

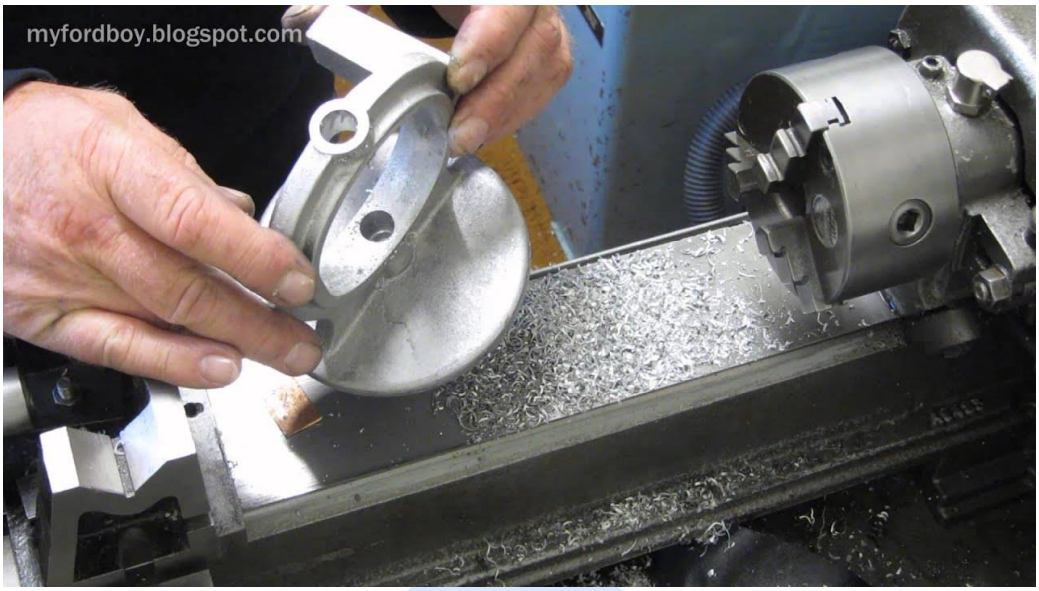


Figure: 12 Machining

12. Inspection and Testing

- **Dimensional Inspection**: Verify dimensions using tools like callipers, micrometres, and CMM (Coordinate Measuring Machines).
- **Non-Destructive Testing (NDT)**: Conduct NDT methods such as ultrasonic testing, magnetic particle inspection, and radiographic testing to detect internal defects.
- **Mechanical Testing**: Perform tests like tensile strength, hardness, and impact resistance to ensure material properties meet specifications.

13. **Surface Treatment**

- **Coating**: Apply protective coatings, such as paint or galvanizing, to prevent corrosion and improve appearance.
- **Surface Finishing**: Conduct final surface finishing processes to meet customer requirements.

14. Packaging and Shipping

- **Packaging**: Pack the finished castings appropriately to prevent damage during transit.
- **Documentation**: Prepare necessary documentation, including inspection reports and certifications.
- **Shipping**: Dispatch the castings to customers or warehouses.

Testing processes

Visual Inspection:

- **Purpose:** To check for surface defects such as cracks, porosity, or other irregularities.
- **Procedure:** Inspect the castings under good lighting conditions. Use magnifying tools if necessary to identify minor defects.

Dimensional Inspection:

- **Purpose:** To ensure the castings meet the specified dimensions and tolerances.
- **Procedure:** Use callipers, micrometres, and coordinate measuring machines (CMM) to measure various dimensions of the casting.

Chemical Analysis:

- **Purpose:** To verify the chemical composition of the ductile iron.
- **Procedure:** Perform spectrometric analysis or use optical emission spectroscopy (OES) to determine the content of elements like carbon, silicon, manganese, sulphur, phosphorus, and magnesium.

Mechanical Testing:

- **Purpose:** To assess the mechanical properties such as tensile strength, yield strength, and elongation.
- **Procedure:**
  - **Tensile Testing:** Conducted using a universal testing machine (UTM) on prepared specimens.
  - **Hardness Testing:** Perform Brinell, Rockwell, or Vickers hardness tests on different areas of the casting.

Microstructure Analysis:

- **Purpose:** To examine the graphite nodularity and matrix structure.
- **Procedure:** Prepare samples by cutting, mounting, polishing, and etching. Examine under a metallurgical microscope.

Ultrasonic Testing (UT):

- **Purpose:** To detect internal defects such as voids, inclusions, or discontinuities.

- **Procedure:** Use ultrasonic waves to scan the casting and identify any internal flaws by interpreting the reflected signals.

Magnetic Particle Inspection (MPI):

- **Purpose:** To detect surface and near-surface defects.
- **Procedure:** Magnetize the casting and apply magnetic particles. Observe under UV light for indications of defects where particles accumulate.

Radiographic Testing (RT):

- **Purpose:** To detect internal defects and verify the integrity of the casting.
- **Procedure:** Use X-rays or gamma rays to create images of the internal structure. Analyse the radiographs for any signs of defects.

Pressure Testing:

- **Purpose:** To ensure the castings can withstand operational pressures without leaking.
- **Procedure:** Subject the casting to a specified pressure using water, air, or oil. Check for leaks or deformation.

Impact Testing:

- **Purpose:** To determine the impact toughness of the material.
- **Procedure:** Conduct Charpy or Izod impact tests on notched specimens to measure the energy absorbed during fracture.

Corrosion Testing:

- **Purpose:** To evaluate the resistance of ductile iron to corrosion.
- **Procedure:** Expose the castings to corrosive environments or perform accelerated corrosion tests such as salt spray tests.

Thermal Analysis:

- **Purpose:** To understand the thermal properties and behaviour under high temperatures.
- **Procedure:** Conduct differential thermal analysis (DTA) or thermogravimetric analysis (TGA) to study the material's response to temperature changes.

Methodology Used for Ascertaining to product standard other than Indian standard

a) Standard(s) that are followed (international/other country/company standard) for the product requirements and methods of test.

RBA Exports Private Limited follows several standards as per the requirement and export of the products, including:

- ASTM A48
- EN 1563
- EN 1561

b) Are they aware of Indian Standards pertaining to the product?

Yes, RBA Export Private Limited is aware of the relevant Indian Standards (IS

c) If yes and still not following the Indian Standards then reasons for preferring those standards.

RBA Export Private Limited prefers other international standards over Indian Standards, it may be due to:

- Specific requirements of their international clients.
- Perceived higher recognition or trust in certain international standards.
- Existing certifications and processes that align more closely with international standards.
- They export their products in abroad (like USA and Mexico etc.)
- Indian standard are no equivalent to international standard.

d) Is the firm getting their product certified against that standard?

Yes, the firm ensures that their products are certified against the relevant international standards to meet the compliance requirements of their global clients.

e) Are the products meant for export or domestic use?

The primary focus of RBA Export Private Limited is on the export market, although they also cater to domestic clients as needed.

f) List of their major customers (Government or private institutions or retail consumers).

RBA Export Private Limited's major customers include:

- International retail chains.
- Government procurement agencies.
- Large private corporations.
- Wholesale distributors.

g) Whether there is any demand from the customers for compliance and certification against any standard other than the Indian Standard. If yes, the intern should make an attempt to collect such tender specifications and details of those standards from the firm.

Yes, the details given in table 3.

h) Manner and extent to which the standards adopted by them deviate from the requirements given in the Indian Standards.

The difference is given in table 3.

i) Suggestions for changes that may be required in the Indian Standards for making them amenable for use.

- Alignment with international standards to facilitate easier global trade.
- Incorporating more rigorous quality and safety measures.
- Regular updates to reflect technological advancements and industry practices.

j) What can be done by BIS to lay the emphasis of buyers on compliance and certification to Indian Standards rather than these standards?

- Increase awareness and trust in Indian Standards through international collaborations and marketing.
- Ensure Indian Standards are regularly updated and aligned with global standards.
- Provide incentives for businesses to adopt and get certified in Indian Standards.

k) Any change in the BIS certification process required to enable easy adoption and certification against the Indian Standards.

- In the test report the lab should report either the product is pass or fail in a feedback column.

Table 3: Comparison between IS 210 & ASTM a48

Clause	Indian Standard (IS 5789)	EN 1563	Recommendation
Clause 5	MANUFACTURE The method of manufacture shall be left to the discretion of the manufacturer provided that the castings always conform to this standard.	The method of producing spheroidal graphite cast irons and their chemical composition shall be left to the discretion of the manufacturer who shall ensure that the requirements of this European Standard are met for the material grade specified in the order. □ ferritic to pearlitic spheroidal graphite cast irons. For these grades, the level of the mechanical properties is determined by the ferrite to pearlite ratio. This ratio is normally adjusted by alloying with pearlite stabilising elements or, less commonly, by heat treatment. □ solid-solution strengthened ferritic spheroidal graphite cast irons. For these grades, the level of the mechanical properties is determined by the extent of solid solution strengthening of the ferritic matrix. This extent is normally governed by the silicon content	N/A
Clause 6	CHEMICAL COMPOSITION The castings, when tested in accordance with the relevant parts of IS 228 shall have the following chemical composition: Constituent Percent Total carbon 2.2 to 2.7 Silicon 1.5 to 2.5 Manganese 3.75 to 4.5	Designation Si % P % Mn % EN-GJS-450-18 5.3108 3,20 0,05 0,50 EN-GJS-500-14 5.3109 3,80 0,05 0,50 EN-GJS-600-10 5.3110 4,30 0,05 0,50 a Si content may be lower due to other alloying elements. b with lower Mn	N/A

	Nickel 21.0 to 24.0 Chromium 0.10 Max Phosphorus 0.08 Max	content (e.g. 0,30%), machinability and elongation will be improved.	
	No grades are mentioned in IS	Grades wise tensile test, hardness, impact test result are given.	
Clause 7	WORKMANSHIP AND FINISH 6.1 The castings shall be accurately moulded in accordance with the pattern or working drawings supplied by the purchaser, with addition of such letters, figures or marks as may be specified. 6.2 The drawings shall specify the tolerance on all important dimensions. On other dimensions, tolerances according to IS 8350: 1977 shall apply.	9.1 The surface of the casting shall be free of adhering sand, scale, cracks, and hot tears, as determined by visual examination. 9.2 No repairing by plugging or welding of any kind shall be permitted unless written permission is granted by the purchaser.	Grades may be mentioned
Clause 8	HEAT TREATMENT 7.1 Unless otherwise agreed to, all castings shall be heat treated in accordance with 5 of IS I3655: 1993. 7.1.1 Heat treatment shall be performed before machining except in cases where re-heat treatment is necessary.	No heat treatment is required after casting.	N/A
Clause 9	No microstructure is mentioned.	Matrix Structure The matrix should be predominantly ferrite with a maximum pearlite content of 5 %. The amount of free cementite should not exceed 1 %.	A matrix structure specification is proposed to mention in IS.

Clause 10	FREEDOM FROM DEFECTS All castings shall be free from surface defects, such as burnt-on sand and shall be reasonably smooth. Runners, risers, fins and other extraneous metals shall be removed from the castings.	The final product is grinded and machined to remove surface defects. Those are free from that are ready for shipping and those are not, are rejected and used as a foundry return product for charging.	N/A
Clause 11	9 TEST SAMPLES 9.1 Test samples shall be cast separately in sand moulds. They shall be poured from the same ladle of metal as used to produce the castings they represent and immediately after the castings are poured. Recommendations regarding test samples are given in Annex A. 9.2 All test samples shall be heat-treated similar to, simultaneously with and adjacent to the castings or castings they represent.	Test pieces machined from samples cut from a casting If applicable, the manufacturer and the purchaser shall agree on: □ the location(s) on a casting where the sample(s) shall be taken; □ the mechanical properties that shall be measured; □ the minimum values, or allowable range of values, for these mechanical properties.	N/A
	10 SAMPLING FOR MECHANICAL TESTS 10.1 The test samples shall be cast from each ladle after pouring of minimum 50 percent of the ladle metal provided the manufacturer ensures nodularity in the first and last poured. 10.2 If successively treated ladles filled from one furnace are used to produce castings. tensile test shall be made from each ladle of metal it treated with nodulizing agent. 10.3 One tensile test at	This standard states about • Separately cast • Side by side cast • Cast on sample	proposed to add the other types also.

	room temperature and three impact tests at the required low temperature shall be performed for each ladle treated with nodulizing agent unless otherwise specified.		
Clause 14	TENSIL.E TEST 11.1.1 Tensile Test The tensile test shall be carried out in accordance with IS 1608: 1972, unless otherwise agreed to between the purchaser and the manufacturer. The test pieces shall have a gauge diameter of 14 mm and a gauge length of 70 mm (see Fig. 1). To determine compliance for proof stress requirements the material tested shall be considered to have passed the test if it does not undergo any elongation exceeding the specified percentage on being subjected to the specified minimum stress for a period of 15 seconds.	13.1 For test Bar A, the tension-test specimen A, as shown in Fig. 1, shall be machined concentric with the axis of the test bar. 13.2 For test Bar B, the tension test specimen B, as shown in Fig. 1, shall be machined concentric with the axis of the test bar. 13.3 For test Bar C, tension test specimens B or C, as shown in Fig. 1, shall be machined concentric with the axis of the test bar. Unless the size of the tension test specimen to be machined from test bar C is specified in writing by the purchaser, the decision whether to use tension test specimen B or C shall be made by the manufacturer of the castings. 13.4 For test bar S, the nature and dimensions of the tension test specimen shall be determined by agreement between the manufacturer and purchaser	N/A
Clause 15	11.1.1 the tensile properties shall be as specified below: Characteristic Requirement Tensile strength MPa 430 Proof stress (0.2 percent), 200 MPa, Min	14.1 Tension test specimens shall fit the holders of the testing machine in such a way that the load shall be axial. 14.2 The elapsed time from the beginning of loading in the tension test to the instant of fracture shall be not less than 15 s for test specimen A and	N/A

	Elongation percent, Min 25	not less than 20 s for specimens B and C.	
Clause 16	11.1.2 Hardness Test The brine11 hardness of the material, when tested in accordance with IS 1500: 1983 shall be between 120 to 180 HB. The hardness test shall preferably be carried out by using a ball of 10 mm diameter and a load of 3 000 kgf..	Round hardness values to the nearest 10 HBW. No specific hardness is mentioned.	It may be agreed to the purchaser.
Clause 17	11.2 Low Temperature Impact Test Notched bar impact properties of the castings shall be determined by testing a set of three Charpy V-notch test specimens as described in IS 1757: 1988. The test temperature shall be agreed upon by mutual consent between the purchaser and the manufacturer. The average energy value of the three test specimens shall not be less than 2.1 kgf..m, with none of the individual value less than 1.4 kgf..m for test temperature down to and including - 19.X.	Impact test The impact test shall be carried out on three Charpy V-notched impact test pieces in accordance with EN ISO 148-1:2010, using test equipment with an appropriate energy to determine the properties correctly	N/A
Clause 19	12 RETEST 12.1 Retest for Chemical Analysis If a sample selected for testing fails to meet the requirements specified under 5.1, the purchaser shall select two further samples from the same cast or ladle. If on testing,	Retests 10.1 Need for retests Retests shall be carried out if a test is not valid. Retests are permitted to be carried out if a test result does not meet the mechanical property requirements for the specified grade. Test validity	N/A

	either of these samples fails to meet the specified requirements, the whole lot shall be deemed as not complying with the standard 12.2 Should any of the original test pieces fail to pass any of the mechanical tests specified under 11.1 and 11.2 two further samples, which represent the same casting or castings, shall be selected and tested in the same manner. The manufacturer shall have the right, if he so desires, to reheat-treat (not more than once) the castings before the two further samples are selected. Should the two further samples satisfy the test requirements of this standard, the castings represented by them shall be accepted. Should either of the retests fail, the castings represented shall be deemed as not complying with this standard. 12.2.1 In case of failure of any test specimen showing obvious casting defects, another test specimen shall be cut from the test sample or from another test sample representing the same metal and the results obtained from this substituted for those obtained from the defective test specimen.	A test is not valid if there is: a) a faulty mounting of the test piece or defective operation of the test machine; b) a defective test piece because of incorrect pouring or incorrect machining; c) a fracture of the tensile test piece outside the gauge length; d) a casting defect in the test piece, evident after fracture. In the above cases, a new test piece shall be taken from the same cast sample or from a duplicate sample cast at the same time, to replace those invalid test results.	

	Subject to mutual agreement between the purchaser and the manufacturer any one or more of the following tests may be agreed upon at the time of enquiry and order: a) Hydrostatic pressure test, b) Radiographic or other non-destructive test, c) Fracture test, and d) Micro-structure test.	No such test is mentioned in there standard	Additional tests may be omitted.
Clause 21	14 MARKING The castings shall be legibly marked with the following particulars: a) Indicating the source of manufacturer; and b) Any other marking as agreed to between the purchaser and the supplier.	When the size of the casting permits, each casting shall bear the identifying mark of the manufacturer and the part or pattern number at a location shown on the covering drawing or, if not shown on the drawing, at a location at the discretion of the producer.	N/A

Recommendation: Recommendations are given in the Table No 3.

INDUSTRY VISIT

GLOBAL SEAMLESS TUBES AND PIPES PVT. LTD., NAUPALA

Introduction: Global Seamless Pipes and Tubes Private Limited is a prominent manufacturer and supplier of high-quality seamless pipes and tubes. The company specializes in producing seamless carbon steel pipes and tubes, which are widely used in various industries, including oil and gas, petrochemical, power generation, automotive, and construction.

Product Range: Offers a diverse range of seamless pipes and tubes in various sizes, grades, and specifications to cater to the specific needs of different industries.

Figure: 13 Seamless Pipes

Standards they follow:

ASTM a192: Standard Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service

1. This specification covers minimum-wall-thickness, seamless carbon steel boiler and superheater tubes for high pressure service.
2. The tubing sizes and thicknesses usually furnished to this specification are 1⁄2 in. to 7 in. [12.7 to 177.8 mm] outside diameter and 0.085 to 1.000 in. [2.2 to 25.4 mm], inclusive, in

minimum wall thickness. Tubing having other dimensions may be furnished, provided such tubes comply with all other requirements of this specification.

3. Mechanical property requirements do not apply to tubing smaller than 1⁄8 in. [3.2 mm] inside diameter or 0.015 in. [0.4 mm] thickness.

4. The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order.

ASTM a179: Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes

1 This specification2 covers minimum-wall-thickness, seamless cold-drawn low-carbon steel tubes for tubular heat exchangers, condensers, and similar heat transfer apparatus.

2 This specification covers tubes 1⁄8 to 3 in. [3.2 to 76.2 mm], inclusive, in outside diameter. NOTE 1—Tubing smaller in outside diameter and having a thinner wall than indicated in this specification is available. Mechanical property requirements do not apply to tubing smaller than 1⁄8 in. [3.2 mm] in outside diameter or with a wall thickness under 0.015 in. [0.4 mm].

3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order.

Process Flow Chart

The process flow chart outlines the steps from order execution to ready for dispatch at Global Seamless Tubes & Pipes Pvt. Ltd. Here's a detailed description of each process step:

1. **Enquiry**

- Initial customer inquiry about products and services.

2. **Feasibility Approval**
   - Assessment of technical and production feasibility.
3. **Quotation Approval**
   - Preparation and approval of a price quote for the customer.
4. **Purchase Order Acceptance**
   - Official acceptance of the customer's purchase order.
5. **Work Order Creation**
   - Creation of internal work orders based on the purchase order.
6. **Raw Material Indent/R.M Selection**
   - Selection and procurement of raw materials required for production.
7. **Raw Material Inspection/VDI/Chemical Analysis**
   - Inspection and chemical analysis of raw materials to ensure quality.
8. **Process Sheet Creation**
   - Documenting the process parameters and steps for production.
9. **Rolling Plan Creation**
   - Creating a detailed rolling plan for the production process.
10. **Billett Cutting**
    - Cutting billets to the required length for production.
11. **Billet Charge on Walking Earth Furnace**
    - Heating billets in a walking hearth furnace for further processing.
12. **Rolling Piercing**
    - Piercing the raw material to create hollow sections.
13. **Online Visual & Dimension Checking**
    - Continuous visual and dimensional checks during production.
14. **Sizing**
    - Determining the appropriate sizes and dimensions for the raw materials.
15. **Online Visual & Dimension Checking**
    - Continuous visual and dimensional checks during production.
16. **Cooling Bed**
    - Cooling the tubes.
17. **Straightening**
    - Straightening the tubes to ensure they are perfectly aligned.
18. **End Cutting**
    - Cutting the tubes with a specified length.

19. **Offline Visual & Dimension Checking**
    - Visual and dimensional checks after cutting.
20. **Transfer to STP (Surface Treatment Plant)**
    - It contains various processes that mentioned below.
21. **Acid Bath Dipping**
    - Put the tubes in H2So4(For other steel) or HNO3 (For Stainless Steel)
22. **Water Rinse**
    - Rinsing the tubes with water to remove any residues.
23. **Phosphate Bath**
    - Treating the tubes in a phosphate bath for surface protection.
24. **Soaping Bath**
    - Cleaning the tubes in a soaping bath.
25. **Hot Air Drier**
    - Drying the tubes using hot air.
26. **Pointing/Swaging**
    - Pointing or swaging the ends of the tubes for further processing.
27. **Cold Drawing Process**
    - Cold drawing the pierced billets to achieve the desired dimensions.
28. **Heat Treatment**
    - Again, Normalisation is done at around 650°C.
29. **Tensile Test & Hardness Test**
    - Then Tensile testing and Rockwell Hardness is done
30. **Straightening**
    - Again, Straightening the tubes to ensure they are perfectly aligned.
31. **Length Cutting**
    - Cutting the tubes to the required lengths.
32. **NDT Test**
    - Non-destructive testing to check for internal and surface defects.
33. **Hydro Test**
    - Hydraulic testing to ensure the tubes can withstand internal pressures.
34. **Visual & Dimension Check**
    - Final visual and dimensional checks before finishing.
35. **Stencilling/Marking**
    - Marking the tubes with necessary information and specifications.
36. **Rust Preventive Oiling**

- Applying rust preventive oil to protect the tubes.

37. **Black Lacquer Paint**
    - Applying a coat of black lacquer paint for corrosion resistance.
38. **Transparent Varnish**
    - Applying a transparent varnish for additional protection and appearance.
39. **End Cap/Hex Bundle**
    - Placing end caps or creating hex bundles for shipment.
40. **Steel Strapping/HDPE Cloth Wrapping**
    - Securing the bundles with steel straps or HDPE cloth wrapping.
41. **Bundle Wrapping with Metal Tag**
    - Bundling the tubes and attaching a metal tag for identification.

Testing Methods

1. Flattening Test

1. The flattening testing shall be carried for the tubes/pipes as per product specification.
2. Universal Testing Machine shall be used.
3. The material shall be verified for size/H. No/specification with the process sheet/W.O.
4. The flattening test is measured by the distance between the parallel plates (H).
5. The distance-H is varied according to the dimensions and the material specification.
6. The specimen should not be less than 2 1/2 in (63.5 mm) in length as per product specification.
7. The section of tube/pipe shall be flattened cold between parallel plates in two steps.
8. During testing, the test specimen should be flattened until the distance between the plates is less than the value of H, calculated by the following equation:

$$H = \frac{(1 + E) * T}{E * \frac{T}{D}}$$

where:

- H: Distance between flattening plates (mm)
- T: Specified wall thickness of the tube (mm)

- D: Specified outside diameter of the tube (mm)
- E: Deformation, per unit length.

9. During the test, no cracks or breaks on the inside, outside, or end surface shall occur.
10. The test results shall be recorded in the reporting format.

2. Tensile Test

1. The tensile testing shall be carried for the tubes/pipes as per relevant standard.
2. The material shall be verified for size/H. No/specification with the process sheet/W.O.
3. Mechanical values as per process sheet & specification.
4. The specimen of full-size tubular sections shall be identified and cut from it.
5. For larger sizes of tubular products which cannot be tested in full section, the longitudinal test specimens are obtained from strips cut from the tubular section machined to the specified size.
6. The specimen shall be marked with the relevant specification requirement.
7. The specimen shall be checked for width and W.T. (specification requirement).
8. The test specimen shall be fixed in the universal testing machine, and the gauge length for elongation is measured at the centre and also at the centre where the thickness should be determined.
9. The tensile machine is allowed to grip the specimen in such a way that the tubular specimen should be fixed in the center where the specified load is applied.
10. Select the required load for the specimen to be tested.
11. Set the machine to zero reading.
12. The specimen shall be gripped and the micrometer is placed in the middle.
13. The test shall be started by giving load to the specimen.
14. Readings on testing shall not be greater than that at which load and strain measurement are made accurately.
15. The specimen of the material under test is recorded when the micrometer drops from the specimen and there is a halt or hesitation of the load. No load increases on the specimen.
16. The specimen shall be removed from the specimen after the yield load has been determined.
17. Ultimate load is recorded when the pointer stands and starts giving negative readings.
18. The ruptured specimen shall be checked for the final elongation by fitting the ends of the fractured specimen together carefully and measuring the distance between the gauge lengths, and this elongation is given as follows:

19. If any part of the fractured specimen breaks outside of the middle half of the gauge length or the extension is less than the specified amount, further tests may be made as per the material. If the elongation or yield or ultimate values are within the specified limits, dissheet the test and measure the results.
20. The following results shall be calculated as follows:
    - Area Calculation: OD −THK×THK× (3.145
    - Yield Strength: Yield Load/Area
    - Tensile Ultimate Strength: Ultimate Load/Area
21. The test results shall be recorded in the reporting format.

3. Flaring Test / Drift Test

1. The flaring test/drift test shall be carried for the tubes as per material specification.
2. Universal Testing Machine shall be used.
3. This test consists of driving a tapered mandrel into a section cut from the tube and thus expanding the specimen until the inside diameter has been increased to the extent required by the applicable specification.
4. The tapered mandrel shall have a slope of 1 in 10 or 60 degrees included angle.
5. The product shall be verified for size/H. No/specification with the process sheet/W.O.
6. The specimen shall be cut approximately 4 in (100 mm) in length as per product specification.
7. The specimen shall be placed on the tapered mandrel and sufficient load shall be applied until the tube at the mouth of the flare has been expanded to the percentages.
8. The tube at the mouth of the flare after it has been expanded to the specified requirement, shall not show any cracks or flaws. In case of failure, two-flare tests shall be conducted on the same lot. If both the tests pass, the lot is accepted and if failed the lot is rejected.
9. The test results shall be recorded in the reporting format.

4. Rockwell - Hardness Test

1. The product shall be identified and cut to length of 50 mm approximately.
2. The material shall be verified for size/H. No/specification/hardness with the process sheet/W.O.
3. The hardness test shall be carried for the tubes/pipes as per applicable product specification.
4. Rockwell hardness test shall be used.

5. The Rockwell hardness test shall be made on the inside surface, on the wall cross section, or on a flat on the outside surface of the tubes.
6. Hardness testing shall be verified by standard block for any doubt.
7. Tubes less than 1.70 mm in wall thickness, the hardness test not required.
8. A minor load of 10 kgf is first applied to the specimen, which causes initial penetration, sets the penetrator on the specimen and holds it in position.
9. A major load which depends on the scale being used is applied increasing the depth of indentation.
10. The major load is removed and, with the minor load still acting, the Rockwell number, which is proportional to the difference in penetration between the major and minor loads is shown in the dial.
11. The scales used are as follows:

Table 4: Rockwell Hardness

Symbol	Penetrator	Major Load (kgf)	Minor Load (kgf)
B	1/16-in steel ball	100	10
C	Diamond ball	150	10

12. Minimum 3 readings shall be taken on the specimen.
13. The test results shall be recorded in the reporting format.

5. Bend Testing

Scope: Seamless tubes & pipes.

Reference standards: ASTM A370, E290, IS2329.

Safety Precautions: Use of safety shoes, hand gloves.

Sampling: Sampling for a bend test shall be performed in accordance with the requirements of relevant standards/spec.

Steps & Procedure:

1. Bend testing shall be carried for the tubes/pipes as per relevant specification.

2. The material shall be verified for size, grade, heat number, work order number, specification with the process sheet.
3. Length of test specimen at least minimum 1.0 metre.
4. Mark the gauge length (L) and the distance to bend centre (A) as per spec.
5. The specimen shall be placed in the mandrel in the bending device.
6. The distance between supports (d) & bend diameter (D) shall be determined as follows:
7. Using the mandrel, the bend test shall be performed by bending the specimen 180 degrees or the specified angle.
8. During the test, the test specimen shall not show any cracks, fractures, or other breaks.
9. In the event of a failure, two additional tests shall be conducted. If both pass, the lot is accepted; if not, the lot is rejected.
10. The test results shall be recorded in the reporting format.

Methodology used for ascertaining product standard other than Indian standard

a) Standard(s) that are followed (international/other country/company standard) for the product requirements and methods of test.

- Product Standard: ASTM a106, ASTM a179, ASTM a210, ASTM a333, V a334 etc.
- Method of Test: ASTM a370 for Mechanical Test, ASTM E415 for Chemical Test

b) Are they aware of Indian Standards pertaining to the product?

Ans: No

c) If yes and still not following the Indian Standards then reasons for preferring those standards.

Ans: N/A

d)Is the firm getting their product certified against that standard?

Ans: Yes, the firm ensures that their products are certified against the relevant international standards to meet the compliance requirements of their global clients.

e) Are the products meant for export or domestic use?

Ans: Both exports and Domestic markets.

f) List of their major customers (Government or private institutions or retail consumers).

Exports	Domestic Market
• Dolphin Heat Transfer Agency (UAE) • Optima Steel Agency (USA) • Ferguson (USA) • United Pipe & Steel (USA) and also • France • Brazil • UK	• Gujrat • Bangalore • Mumbai etc.

g) Whether there is any demand from the customers for compliance and certification against any standard other than the Indian Standard. If yes, the intern should make an attempt to collect such tender specifications and details of those standards from the firm.

Ans. Yes, there is often a demand from Indian customers for compliance with specific international standards (e.g. ASTM).

h) Manner and extent to which the standards adopted by them deviate from the requirements given in the Indian Standards.

Ans. Material tolerance, Physical Property, Test Requirement

i) Suggestions for changes that may be required in the Indian Standards for making them amenable for use.

Ans. No suggestion is provided.

j) What can be done by BIS to lay the emphasis of buyers on compliance and certification to Indian Standards rather than these standards?

Ans. BIS can make the equivalent standards of the international standards that the buyers can use it for their requirements.

k) Any change in the BIS certification process required to enable easy.

Ans. No

Table 5: Comparison between IS 2416 & ASTM a192

Clause	Indian Standards IS 2416	ASTM a192	Recommendation
Clause 3	MANUFACTURE 3.1 Tubes shall be manufactured by one of the following processes: CFS Cold finished seamless Part 2 HFS Hot finished seamless Part 3 ERW - Electric resistance welded and induction welded Part 4 CEW - Cold finished electric resistance welded and induction welded Part 4 a) Seamless Tubes - The tubes stall be manufactured by a seamless process and may be hot finished or cold finished. b) Welded Tubes - The tubes shall be manufactured from either hot or cold rolled steel strip longitudinally	Tubes shall be made by the seamless process and shall be either hot-finished or cold-finished, as specified.	N/A

	welded continuously by the passage of an electric current across the abutting edges without the addition of filler metal.		
Clause 4	DESIGNATION 4.1 The following grades of steels shall be used. a) Carbon steels Grades 310, 360 and 440 b) Ferritic alloy steels Grade 460 to 560 Grade 500 to 620 The tubes shall be designated by one of the references given for the method of manufacture, for example, hot finished seamless tubes made from grade 310 is 'HFS 310'.	No such designation is mentioned.	Grades may be omitted.
Clause 5.1	The tubes shall be manufactured from steel produced by open hearth, an electric arc or any of the oxygen processes. The chemical composition of each heat when analyzed in accordance with IS: 228. shall conform to the following analysis: Carbon 0.08 to 0'25 percent	The steel shall conform to the following requirements as to chemical composition: Carbon, % 0.06–0.18 Manganese, % 0.27–0.63 Phosphorus, max, % 0.035 Sulfur, max, % 0.035 Silicon, max, % 0.25	Alloy grades also may be omitted.

	Manganese 0.35 to 1'40 percent Silicon 0.35 percent, Max Phosphorus 0.050 percent Max Sulphur 0.050 percent, Max		
Clause 5.1.1	For alloy steels the trump elements shall be restricted to the following upper limits: Copper 0.25percent Tin 0.03percent Nickel 0.3 percent Soluble Aluminium 0.02 percent Chromium 2.25 percent, Max Molybdenum 1.0 percent, Max	Supplying an alloy grade of steel that specifically requires the addition of any element other than those listed in previous point is not permitted.	N/A
Clause 7	SELECTION OF TUBES FOR TESTING 7.1 Selection of Tubes for Testing - Two percent of the tubes of each	When requested on the purchase order, a product analysis shall be made by the supplier from one tube per 100 pieces for sizes over 3 in.	N/A

	thickness and diameter and only one for every 100 or part thereof above 400 tubes of such similar size shall be made available to the Inspecting Officer for testing to the extent of such numbers	[76.2 mm] and one tube per 250 pieces for sizes 3 in. [76.2 mm] and under; or when tubes are identified by heat, one tube per heat shall be analysed. The chemical composition thus determined shall conform to the requirements specified. If the original test for product analysis fails, retests of two additional billets or tubes shall be made. Both retests, for the elements in question, shall meet the requirements of the specification; otherwise, all remaining material in the heat or lot shall be rejected or, at the option of the producer, each billet or tube may be individually tested for acceptance. Billets or tubes which do not meet the requirements of the specification shall be rejected.	
	HEAT TREATMENT Grades 310,360 and 440 tubes in cold finished grades shall be subject to annealing/normalizing to	Hot-finished tubes need not be heat treated. Cold finished tubes shall be heat treated after the final cold-	N/A

	a temperature range of 880 to 940°C. For alloy steels the tubes in cold finished grades shall be subject to annealing normalizing to a temperature range of 900 to 960°C followed by tempering at a temperature of 650 to 750°0.	finishing at a temperature of 1200°F [650°C] or higher.	
	ADDITIONAL TESTS 9.1 Should a tube selected for testing fail in anyone or more of the tests specified, two further tests of the same kind may be made on two other tubes from the same batch. Should either of these further tests fail, the batch of tubes represented may be heat-treated again and then retested for all tests, selecting the number of test pieces as given in 7.1. If all the repeat tests are satisfactory, the tubes shall be deemed to comply with this standard provided that they conform in all other respects with the requirement of this standard. But if failure again occurs, the batch of tubes which the test pieces represent shall be deemed not to comply with this standard.	No such test is mentioned	N/A
	TEST CERTIFICATE 10.1 In the test certificates, a statement of process of the		N/A

	manufacture of the steel and the test results shall also be furnished by the manufacturer.		
	CORROSION PROTECTION 11.1 The provisions for corrosion protection of boiler and superheater tubes shall be as agreed to between the manufacturer and the purchaser.		
	MARKING 12.1 Unless otherwise agreed to between the manufacturer and the purchaser, each tube shall be legibly stenciled with the name or brand of the manufacturer, the IS number and grade of the material. For tubes of diameter less than 48 mm, the above information should be marked on a tag securely attached to the bundle or box in which tubes are shipped. 12.2 The material may also be marked with the lSI Certification Mark. NOTE - The use of the lSI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Mark.) Act and the Rules and Regulations made thereunder. The lSI Mark on products covered by an Indian Standard conveys the assurance that they have been	In addition to the marking prescribed in Specification A 450/A 450M, the marking shall indicate whether the tube is hot finished or cold finished.	Hot finished or cold finished may be mentioned in IS.

	produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and. supervised by lSI and operated by the producer. lSI marked products are also continuously checked by lSI for conformity to that standard as a further safeguard. Detail. of conditions under which a license for the use of the lSI Certification Mark may be granted to manufacturers or		
	INFORMATION TO BE SUPPLIED BY THE PURCHASER 13.1 The purchaser shall state the following in his enquiry and order: a) The number and part of the Indian Standard; b) Method of manufacture of tube and the grade of steel c) The tube dimensions, that is, outside diameter, thickness and length; and d) The quantity in meter~ or numbers of lengths.	Orders for material under this specification should include the following, as required, to describe the desired material adequately: Quantity (feet, metres, or number of lengths), Name of material (seamless tubes), Manufacture (hot-finished or cold-finished), Size (outside diameter and minimum wall thickness), Length (specific or random), Optional requirements	N/A

		Test report required (see section on Certification of Specification A 450/A 450M), Specification designation, and 3.1.9 Special requirements	
	No hardness test is mentioned.	The tubes shall have a hardness number not exceeding the following: Brinell Hardness Number (Tubes Rockwell Hardness Number 0.200 in. [5.1 mm] - 137 HB over in (Tubes less than 0.200 in. wall thickness) [5.1 mm] in wall thickness) - 77 HRB	Hardness may be mentioned in IS

Recommendation: Recommendations are given in the Table No 5.

CONSUMER VISIT

PUBLIC HEALTH ENGINEERING DEPARTMENT (PHED), KOLKATA

Introduction

The Public Health Engineering Department (PHED) is a government body responsible for the planning, design, execution, and maintenance of water supply and sanitation facilities. Its primary focus is to ensure the provision of safe drinking water and adequate sanitation facilities to the public, particularly in rural and semi-urban areas. PHED plays a crucial role in improving public health standards by ensuring access to clean water and proper sanitation, thereby reducing the incidence of waterborne diseases and promoting overall community well-being.

Product Range: Ductile Iron Pipe, Galvanised Steel Pipe

Figure: 14 Galvanised Steel Tubes

Standards of The Purchased Samples:

IS 8329: CENTRIFUGALLY CAST (SPUN) DUCTILE IRON PRESSURE PIPES FOR WATER, GAS AND SEWAGE – SPECIFICATION

1.1 This standard specifies the requirements and associated test methods applicable to ductile iron pipes manufactured in metal (lined or unlined) or sand moulds and their joints for the construction of pipe lines: - to convey water, sewage or gas - to be installed below or above ground - operated with or without pressure.

1.2 This standard also specifies requirements for materials, dimensions and tolerances, mechanical properties and standard coatings and linings of ductile iron pipes.

1.2.1 This standard does not restrict the use of other types of joints or future developments of other joints as long as overall dimensions are maintained for reasons of safety and interchangeability.

1.3 The standard applies to pipes, which are: manufactured with socketed, flanged or spigot ends for jointing by means of various types of gaskets, which are not with in the scope of this standard, and normally to be delivered externally and internally lined and are suitable for fluid temperatures between 0°C and 5O”C, excluding frost.

1.4 This standard does not include the provisions for fittings used with the pipes conforming to this standard. A separate standard IS -9523 covers the specification on such fittings.

1.5 Fittings conforming to IS 13382 may also be used with ductile iron pipes, when the pressure requirements match.

IS 1239: STEEL TUBES, TUBULARS AND OTHER WROUGHT STEEL FITTINGS — SPECIFICATION

1.1 This standard (Part 1) covers the requirements for welded and seamless plain end or screwed and socketed steel tubes intended for use for water, non-hazardous gas, air and steam. This standard is applicable to tubes of size 6 mm nominal bore to 150 mm nominal bore.

1.2 Medium and heavy tubes only are recommended for carrying steam services. The maximum permissible pressure and temperatures for different sizes of tubes are given in Annex A for guidance only.

Impact on Public Health:

PHED's initiatives have a significant impact on public health by:

- Reducing the prevalence of waterborne diseases such as cholera, diarrhea, and typhoid.
- Improving maternal and child health through better access to clean water and sanitation.
- Enhancing the quality of life and productivity of communities by reducing the burden of water-related illnesses.
- Supporting sustainable development by ensuring that water resources are managed efficiently and responsibly.

Challenges and Future Directions:

Despite its successes, PHED faces several challenges, including:

- Ensuring the sustainability and reliability of water supply systems in the face of growing demand and environmental changes.
- Addressing disparities in access to water and sanitation services between urban and rural areas.
- Securing adequate funding and resources to implement and maintain infrastructure projects.
- Adopting new technologies and innovative approaches to improve service delivery and efficiency.

Moving forward, PHED aims to strengthen its efforts through:

- Enhanced collaboration with other government agencies, non-governmental organizations, and the private sector.
- Increased investment in capacity building and training for its workforce.
- Leveraging advancements in technology for better water management and service delivery.
- Fostering greater community involvement in planning and decision-making processes.

In conclusion, the Public Health Engineering Department plays a vital role in ensuring the health and well-being of communities through the provision of essential water and sanitation services. Its continued efforts are crucial for achieving public health goals and sustainable development.

Role of PWD:

The Public Health Engineering Department (PHED) plays a crucial role in ensuring the provision and maintenance of essential public health infrastructure, primarily focusing on water supply and sanitation services. Here are the key roles and responsibilities of PHED:

1. Water Supply Management

- **Planning and Development**: PHED is responsible for planning, developing, and implementing water supply projects to ensure the availability of safe and adequate drinking water to urban and rural populations.
- **Water Treatment**: It oversees the construction and maintenance of water treatment plants to ensure the provision of clean and safe drinking water.
- **Distribution Network**: PHED manages the distribution network, including pipelines, reservoirs, and pumping stations, to ensure an efficient and reliable supply of water.

2. Sanitation and Waste Management

- **Sewerage Systems**: The department designs, constructs, and maintains sewerage systems to ensure proper disposal and treatment of wastewater.
- **Public Toilets and Sanitation Facilities**: PHED constructs and maintains public toilets and sanitation facilities, especially in urban areas and public places, to promote hygiene and prevent disease.
- **Solid Waste Management**: In some regions, PHED is involved in managing solid waste collection, transportation, and disposal to maintain a clean and healthy environment.

3. Quality Control and Monitoring

- **Water Quality Monitoring**: PHED regularly monitors the quality of water supplied to the public to ensure it meets health and safety standards. This includes testing for contaminants and pollutants.
- **Sanitation Standards**: The department ensures that sanitation facilities and services meet the required health and safety standards to prevent public health hazards.

4. Infrastructure Development and Maintenance

- **Construction Projects**: PHED undertakes various construction projects related to water supply and sanitation infrastructure, including building dams, reservoirs, pipelines, and treatment plants.
- **Maintenance and Repairs**: The department is responsible for the regular maintenance and repair of water supply and sanitation infrastructure to ensure its proper functioning and longevity.

5. Disaster Management and Emergency Response

- **Emergency Water Supply**: During natural disasters such as floods, droughts, or earthquakes, PHED ensures the provision of emergency water supplies to affected areas.
- **Sanitation During Disasters**: The department also sets up temporary sanitation facilities and ensures the proper disposal of waste to prevent disease outbreaks during emergencies.

6. Public Awareness and Community Engagement

- **Awareness Campaigns**: PHED conducts public awareness campaigns on water conservation, hygiene practices, and the importance of sanitation to promote public health.
- **Community Involvement**: The department engages with local communities to involve them in water and sanitation projects, ensuring their needs and preferences are considered.

7. Policy Formulation and Implementation

- **Regulation and Standards**: PHED is involved in formulating policies, regulations, and standards related to water supply and sanitation to ensure uniformity and quality across its services.
- **Implementation of Government Programs**: The department implements various government schemes and programs aimed at improving water supply and sanitation services, particularly in underserved areas.

8. Collaboration with Other Agencies

- **Inter-departmental Coordination**: PHED works in coordination with other government departments, such as health, urban development, and rural development, to ensure a holistic approach to public health engineering.
- **Partnerships with NGOs and Private Sector**: The department collaborates with non-governmental organizations (NGOs) and the private sector to leverage additional resources and expertise for water and sanitation projects.

9. Technical and Capacity Building Support

- **Training Programs**: PHED conducts training programs for its staff and other stakeholders to enhance their technical skills and capacity in managing water and sanitation services.
- **Technical Assistance**: The department provides technical assistance to local bodies and other agencies involved in water supply and sanitation projects.

10. Research and Development

- **Innovative Solutions**: PHED engages in research and development activities to find innovative solutions for water supply and sanitation challenges, including the use of new technologies and methods.
- **Sustainability Initiatives**: The department promotes sustainable practices in water use and sanitation to ensure the long-term availability of resources and protection of the environment.

Tendering Process of Public Health Engineering Department (PHED)

The tendering process in the Public Health Engineering Department (PHED) is a systematic procedure used to procure goods, services, and works for water supply and sanitation projects. This process ensures transparency, competitiveness, and fairness in the selection of contractors and suppliers. Here is a detailed overview of the typical tendering process in PHED:

1. Identification of Needs

- **Requirement Assessment**: The process begins with the identification of needs for new projects or maintenance work. This involves assessing the current infrastructure and identifying areas that require upgrades or new developments.
- **Project Planning**: Detailed planning is done to define the scope, objectives, and specifications of the project. This includes technical, financial, and environmental considerations.

2. Preparation of Tender Documents

- **Tender Notice**: A public notice is issued to invite interested parties to submit their bids. This notice includes essential information about the project, such as its scope, location, and key dates.
- **Tender Documents**: Comprehensive tender documents are prepared, which include:
    - Instructions to bidders
    - Project specifications and requirements
    - Evaluation criteria
    - Contract terms and conditions
    - Bid submission format and deadline

3. Invitation to Tender

- **Public Advertisement**: The tender notice is advertised in newspapers, on the official PHED website, and other relevant platforms to reach a wide audience of potential bidders.

- **Pre-Qualification**: In some cases, a pre-qualification process is conducted to shortlist eligible bidders based on their experience, financial stability, and technical capability.

4. Bid Submission

- **Bidder Queries**: Prospective bidders are allowed to ask questions and seek clarifications about the tender documents. PHED may hold pre-bid meetings to address these queries.
- **Submission of Bids**: Bidders submit their proposals by the specified deadline. The bids are usually submitted in sealed envelopes to maintain confidentiality and integrity.

5. Bid Opening

- **Opening Ceremony**: The received bids are opened in a formal ceremony attended by PHED officials and, sometimes, representatives of the bidders. The names of the bidders and their quoted prices are announced.
- **Initial Review**: The bids are initially reviewed to ensure they meet the basic requirements and are complete.

6. Evaluation of Bids

- **Technical Evaluation**: The technical aspects of the bids are evaluated against the project specifications and requirements. This includes assessing the bidders' proposed methodologies, timelines, and technical capabilities.
- **Financial Evaluation**: The financial proposals are evaluated to determine the cost-effectiveness of each bid. This involves comparing the quoted prices and ensuring they are within the project budget.
- **Combined Assessment**: The technical and financial scores are combined according to a predetermined weighting system to determine the overall ranking of the bids.

7. Award of Contract

- **Recommendation for Award**: Based on the evaluation results, a recommendation is made for awarding the contract to the most suitable bidder.
- **Approval Process**: The recommendation is reviewed and approved by the relevant authorities within PHED.
- **Contract Agreement**: A formal contract is signed between PHED and the selected bidder. The contract includes all terms and conditions, project timelines, payment schedules, and other relevant details.

8. Implementation and Monitoring

- **Project Execution**: The selected contractor commences work as per the agreed terms. PHED monitors the progress to ensure compliance with project specifications and timelines.
- **Quality Control**: Regular inspections and quality control checks are conducted to ensure the work meets the required standards.
- **Payment and Reporting**: Payments are made to the contractor based on the agreed milestones and upon satisfactory completion of work. Regular progress reports are submitted to PHED.

9**. Project Completion and Handover**

- **Final Inspection**: Upon completion of the project, a final inspection is conducted to verify that all work has been done according to the contract specifications.
- **Handover**: The completed project is handed over to PHED, and a completion certificate is issued.
- **Post-Implementation Review**: A review is conducted to evaluate the overall success of the project and identify lessons learned for future projects.

10. Record Keeping and Audit

- **Documentation**: All tender documents, evaluation reports, contracts, and correspondence are properly documented and archived.
- **Audit**: Periodic audits are conducted to ensure compliance with procurement policies and procedures and to identify any areas for improvement.
-

Methodology Used for Ascertaining to Organized Consumers

a) **Evaluate if they use products conforming to standards other than Indian Standards, either non-certified or certified by other bodies. If yes, ascertain reasons for the same.**

They use only ISI products as they get orders from the government to use marked products only.

b) If for that product category, they use both BIS certified and not certified products, their views regarding comparison of both the types of products;

N/A, as they use only ISI marked products.

c) Feedback regarding quality of BIS certified products;

They are satisfied from the BIS certified product, and they haven't faced any issues regarding quality of materials.

d) Determine the additional quality checks, if any, performed by them for accepting the BIS certified products;

They do not perform any additional quality checks, only they perform those tests that are specified in Indian Standards.

e) Percentage of non-compliance of the ISI marked products;

Negligible

f) Actions taken by the firm in case of non-compliance of ISI marked products;

N/A

g) Suggestions to BIS for enhancing product compliance and reliability;

They did not give any suggestions.

h) Does the firm have any policy specifying purchase of ISI marked products;

They don't have any policy as they follow whatever they are ordered to by the government. And they follow the guidelines given by the government.

i) Awareness about BIS portals, such as BIS care App, Know Your Standard, etc.

Yes, they are well aware of BIS portals.

INDUSTRY VISIT

RAMCO CEMENT, KOLAGHAT

Introduction

Ramco Cement, a prominent player in the Indian cement industry, operates a plant in Kolaghat, West Bengal. This facility is part of the company's extensive network of cement manufacturing units across India, contributing to its significant market presence.

Figure: 15 Ramco Cement

Management System Licensees they have:

1.1 ISO 9001

ISO 9001 is a globally recognized standard for quality management systems (QMS). It outlines a framework for organizations to establish, document, implement, and maintain a system that consistently

meets customer requirements and enhances customer satisfaction. The standard focuses on key aspects of quality management, including process management, risk assessment, continuous improvement, and documentation.

The core principle of ISO 9001 is to ensure that organizations consistently deliver products and services that meet customer expectations and applicable regulatory requirements. This involves identifying and managing risks associated with quality, continuously improving processes, and maintaining a system of documentation and records to track progress and demonstrate compliance.

1.2 ISO 14001

ISO 14001 is an international standard that provides a framework for organizations to establish, implement, maintain, and continually improve an environmental management system (EMS). It helps organizations identify, control, and reduce their environmental impact. The standard encourages organizations to adopt a systematic approach to environmental management, considering both their direct and indirect environmental effects.

ISO 14001 helps organizations comply with environmental legislation and regulations, reduce their environmental footprint, and improve their sustainability performance. Implementing an EMS based on ISO 14001 can help organizations conserve resources, minimize waste generation, and promote responsible environmental practices throughout their operations.

1.3 ISO 45001

ISO 45001 is a globally recognized standard for occupational health and safety management systems (OHSMS). It outlines a framework for organizations to proactively identify, assess, and control risks related to occupational health and safety. The standard aims to prevent work-related injuries and illnesses, protect the well-being of workers, and create a safer work.

ISO 45001 emphasizes a systematic approach to health and safety management, including hazard identification, risk assessment, control measures, and continuous improvement. It also encourages organizations to involve workers in health and safety decisions, promoting a culture of safety and responsibility.

Benefits of Implementing ISO Standards

3.1 Enhanced Efficiency

Implementing these standards can streamline processes, reduce waste, and improve operational efficiency.

3.2 Increased Customer Satisfaction

By focusing on customer needs and continuous improvement, organizations can enhance their customer satisfaction.

3.3 Improved Brand Reputation

Achieving certification demonstrates a commitment to quality, environmental responsibility, and workplace safety, boosting brand reputation and credibility.

3.4 Competitive Advantage

These certifications can provide a competitive advantage by differentiating organizations from competitors and attracting customers and partners who value these standards.

DATA ANALYSIS AND INTERPRETATIONS:

4.1 Gross Profit Ratio: Gross profit/Sales*100(Rupees in Lakhs)

Table 6: Gross Profit Ratio

Year	Gross Profit	Scales	Ratios (In Percentage)
2015-2016	247591	358722	69.02
2016-2017	268489	447144	60.05
2017-2018	282239	447809	63.03
2018-2019	317433	506024	62.73
2019-2020	331340	528542	62.69

Source of Data: Company Annual Report 2015-2016 to 2019-20

4.2 Net Profit Ratio: Net profit/Sales*100(Rupees in Lakhs)

Table 7: Net Profit Ratio

Year	Net Profit	Scales	Ratios (In Percentage)
2015-2016	55826	358722	15.56
2016-2017	64929	447144	14.52
2017-2018	55566	447809	12.41
2018-2019	50589	506024	10.00
2019-2020	60109	528542	11.37

Source of data: Company Annual Report 2015-2016 to 2019-20

4.3 Operating Profit Ratio: Operating profit/Sales*100(Rupees in Lakhs)

Table 8: Operating Profit Ratio

Year	Operating Profit	Scales	Ratios (In Percentage)
2015-2016	88430	358722	24.65
2016-2017	96861	447144	21.66
2017-2018	82777	447809	18.48
2018-2019	78475	506024	15.51
2019-2020	81117	528542	15.35

Source of Data: Company Annual Report 2015-2016 to 2019-20

4.4 Inventory Turnover Ratio: Sales/Average Inventories (Rupees in Lakhs)

Table 9: Inventory Turnover Ratio

Year	Scales	Inventories	Ratios (In Times)
2014-2015		52058	
2015-2016	358722	54902	6.71
2016-2017	447144	57543	7.95
2017-2018	447809	55994	7.89
2018-2019	506024	55967	9.04
2019-2020	528542	64526	8.77

Source of Data: Company Annual Report 2015-2016 to 2019-20

4.5 Capital Turnover Ratio: Sales/Capital Employed (Rupees in Lakhs)

Table 10: Capital Turnover Ratio

Year	Scales	Capital Employed	Ratios (In Times)
2015-2016	358722	554079	0.65
2016-2017	447144	498837	0.90
2017-2018	447809	523953	0.85
2018-2019	506024	606049	0.83
2019-2020	528542	771305	0.69

Source of Data: Company Annual Report 2015-2016 to 2019-20

4.6 Asset Turnover Ratio: Net sales/Average Total Assets (Rupees in Lakhs)

Table 11: Asset Turnover Ratio

Year	Scales	Average Total Assets	Ratios (In Times)
2014-2015		700160	
2015-2016	359573	702517	0.51
2016-2017	447144	700890	0.64
2017-2018	447809	709042	0.64
2018-2019	506024	810821	0.67
2019-2020	528542	1004700	0.58

Source of Data: Company Annual Report 2015-2016 to 2019-20

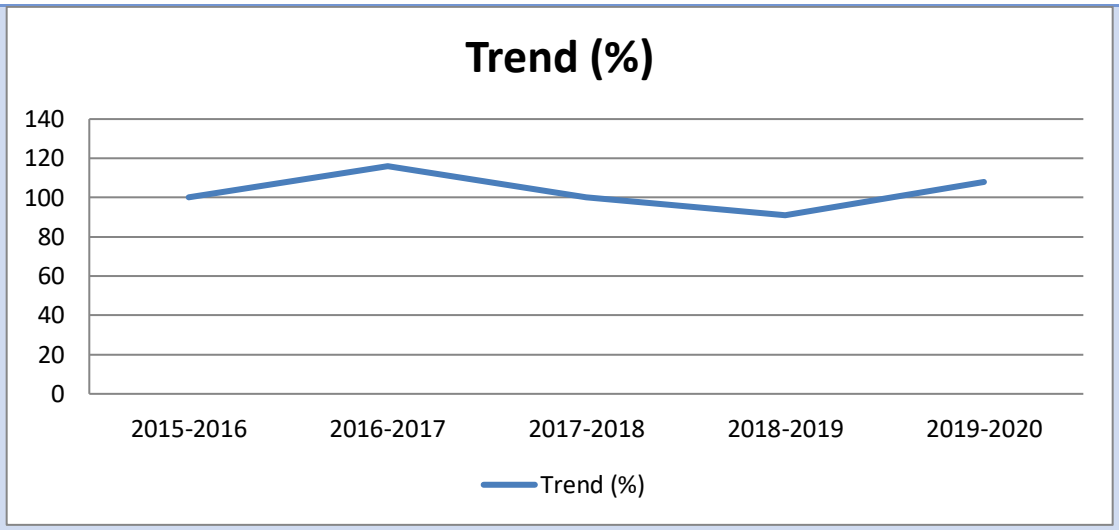
4.7 Stock Turnover Ratios: COGS/Average Inventory (Rupees in Lakhs)

Table 12: Stock Turnover Ratio

Year	COGS	Inventories	Ratios (In Times)
2014-2015		52058	
2015-2016	46410	54902	0.87
2016-2017	45279	57543	0.81

2017-2018	52942	55994	0.93
2018-2019	60507	55967	1.08
2019-2020	69806	64526	1.16

Source of Data: Company Annual Report 2015-2016 to 2019-20



Year	Scales	Trend (%)
2015-2016	55826	100
2016-2017	64929	116
2017-2018	55566	100
2018-2019	50589	91
2019-2020	60109	108

4.8 Trend Percentage of Net Profit Ratio (Rupees in Lakhs)

Source of Data: Company Annual Report 2015-2016 to 2019-20

Certification Process for ISO Standards

4.1 Gap Analysis

An initial assessment to identify the gap between the organization's current practices and the requirements of the chosen ISO standard.

4.2 Documentation Development

Developing and implementing a documented management system that outlines policies, procedures, and responsibilities.

4.3 Internal Audit

Conducting internal audits to ensure the management system is effective and compliant with the standard.

4.4 Certification Audit

A comprehensive audit conducted by an accredited certification body to verify the organization's compliance with the ISO standard.

4.5 Certification

If the audit is successful, the organization is granted certification, valid for a specified period. Regular surveillance audits are required to maintain certification.

Methodology Used for Ascertaining to Management System Certification

Performance of the firm prior to obtaining BIS license.

Performance of the firm prior to obtaining BIS license is:

Table 12: Performance Data prior to BIS License

Metric	Performance Data
Production Capacity	0.8 million tons per annum
Sales Volume	0.6 million tons per annum
Market Share	10% in West Bengal market
Quality Control	80% compliance with industry standards
Customer Satisfaction	70% satisfaction rating
Environmental Compliance	90% compliance with regulatory standards
Technological Advancement	60% adoption of advanced technologies

Operational Efficiency	75% efficiency rating

Enhancement in performance after obtaining BIS license and parameters in which enhancement is observed;

Table 13: Performance Data after BIS Licence

Metric	Performance Data (Before)	Performance Data (After)
Production Capacity	0.8 million tons per annum	1.2 million tons per annum
Sales Volume	0.6 million tons per annum	1.0 million tons per annum
Market Share	10% in West Bengal market	18% in West Bengal market
Quality Control	80% compliance with industry standards	95% compliance with industry standards
Customer Satisfaction	70% satisfaction rating	90% satisfaction rating
Environmental Compliance	90% compliance with regulatory standards	98% compliance with regulatory standards
Technological Advancement	60% adoption of advanced technologies	85% adoption of advanced technologies
Operational Efficiency	75% efficiency rating	90% efficiency rating

Increase in market share after obtaining license;

The plant's market share in West Bengal increased to 18% from 10%. The BIS certification provided a competitive edge over uncertified competitors.

Reduction in expenditure after obtaining license;

Other benefits accrued;

Benefits accrued in terms of;

- Increase in Production Capacity

- Increase in Sales Volume
- Increase in Market Share
- Increase in Operational Efficiency

Whether the firm has any other branch who has also obtained the same license from BIS

Yes, the entire Ramco Cements branch has obtained the 4 management licenses from BIS, except Kolaghat who has obtained for 3 licences from BIS.

Suggestions for improvements in processes of BIS;

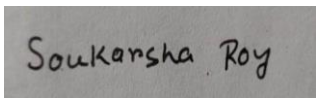
No such suggestion is given by them.

Any other Management System license being held by the unit from some other certifying body as well as the reasons for the same and the differences in the services provided;

No

Any other Management System license being held by other branches/ units of the same firm from BIS or from other certifying bodies.

Except Kolaghat branch of Ramco Cement all other branches also have ISO 50001.



Sign **Sign**

Intern **Coordinating Officer at BO**