Annexure – 3: Technical Specification: Cast Iron Receivers

Quality aspects for casting Grey Cast Iron Receivers

The bidder is requested to note the following,

1. **Marking:**
   - Each receiver casting, shall be legibly marked with a number of identification marks which it can be traced to the melt, from which it was made.
   - Receiver castings complying with the requirements of this standard shall be, after inspection, legibly marked with an acceptance mark.
   - Each receiver shall be accompanied by MTC (Material Test Certificate)/Quality Certificate indicating Chemical composition, Mechanical characteristics and results of ultrasonic tests for flaw detection, as per the details in Section 6 of this Annexure. The certificate shall carry the Indian Standards Institute (ISI) mark confirming to the required Indian Standards (IS) for each individual test.

2. The receiver castings shall also be marked with Standard mark. The marking can be done on the back side of the receiver (closed cavity side) from outside; the necessary provisions can be introduced in the pattern.

3. The bidders have to give proof of their production capacity. Bidders should provide information on their current commitments which will influence the delivery time. The available production capacity shall be computed as mentioned below:
   {Available production capacity for the months XY = total production capacity for the months XY – (existing commitments for the months XY + future or planned commitments for the months XY)}

4. The surface of the casting shall be smooth finish, free of adhering sand, scale, cracks, porosity, blow holes, hard spots, coldshuts, distortion, slag inclusions, hot tears and other harmful defects.

5. Cleaning the outer surface of the Receiver solid body can be done either manually or through sand blasting.

6. No welding or repairs shall be carried out without the prior permission of the purchaser. Welding referred here includes fusion welding in accordance with the common foundry practice.

7. There is no machining required on the casted receiver by the bidder. However, the receiver must be machianble. But the outer diameter required must be of accurate radius with a smooth finish.

8. The bidder must mention the source of raw material for Pig Iron ingot, in the price Bid Annexure- 5. The source of raw material along with the test certificate needs to be furnished by the bidder.

9. Any finished receiver, which is found to be of sub-standard quality, shall be liable for rejection and no payment will be made towards the supply. Rejected materials shall

be replaced at the risk and cost of the tenderer within 7 days from the receipt of notice from GIZ.

10. In case the MTCs are not available or incomplete or when material quality differs from Standard Specifications such material shall not be accepted.

Note: Relevant Test Certificate to be furnished by the bidder for mechanical and chemical specification given in the following sections. The casting of receivers must be in accordance to IS 210:2009 standard.

Description

The Cast Iron Receiver will be used for storing thermal energy in solar thermal power plant. It is made of grey cast iron FG 200 grade as delineated in the IS 210:2009 standard. The mass of the receiver provides simple thermal energy storage mechanism with high heat capacity. The smooth finish enables an improved heat transfer through the heat transfer coils that provides maximum contact surface area with the body of the receiver.

1. Technical Specification

1.1 Pattern making

Appropriate pattern required for the casting shall be prepared in numbers for bulk manufacturing as per the required quantity. The patterns should be produced in such a way that the casted product shall have smooth external final finish. Preferred material for pattern is aluminium considering the bulk quantity order and required smooth finish.

1.2 Metal melting, treatment & casting:

The cast iron is obtained by re-melting pig iron with coke and limestone in a furnace known as cupola or in induction casting. It is primarily an alloy of iron and carbon.

The metals to be used in casting of receiver body can be Pig Iron Ingots, part of scrap metal and other special additives as per the metallurgical process requirements. The final combination of receiver body should have following chemical composition in the Grey iron casting containing:

1. Carbon – 3.3% to 3.5%,
2. Silicon – 1.6% to 2.0 % and
3. Iron – 94.5% to 95.5%

2. Standards

The material combination for casting should suit machine works on the receiver body. The casting should adhere to ASTM A-48 standards or IS 210: 2009 standard with minimum tensile strength of 200MPa and BHN hardness of 150 to 160.

3. Dimensional tolerances

The casting shall be as per the drawing attached for the receiver body. The surface shall be smooth finish with below mentioned dimensional tolerance:

- Outside diameter ± 2%;
- Ovality dimension ± 2%;
- Weight of ± 2.5%

4. Quality checks and Testing Certification required

The following parameters shall be checked by the GIZ for the receivers.

- **Visual inspection:** The surface of the casting shall be smooth finish, free of adhering sand, scale, cracks, porosity and hot tears.
- **Chemical composition test**: The bidder will certify the material composition of Carbon and Silicon content by taking the core sample of each receiver either at the testing facility available in-house or through an external lab at its own cost. GIZ has the right to get the sample tested for each receiver at a third party testing lab and verify the test results with the test certificate provided by the bidder.
- **Non-destructive testing (NDT) test for checking porosity, cracks, air gaps in solid cast body:**
    - GIZ may conduct (not necessarily) applicable tests towards checking of defects on account of improper casting - check on porosity, cracks, air gaps etc. in the body. This test can be conducted either at the in-house test facilities or by arranging a test facility on rental.
    - The cost towards such test of the receiver body shall be borne by GIZ.
    - If any sample checked by the GIZ fails on such tests, the supplier will have to conduct the test for each receiver at his own account.

Any receiver failing any of the above tests will not be taken by the GIZ and supplier will provide the replacement with a technically qualified receiver at its own cost.

Relevant Test Certificate to be furnished by the bidder for mechanical and chemical specification given below.

Provision of test bars: as per the specifications mentioned in IS 210:2009 standard.

5.1 Mechanical properties

Description	Required specification
Raw material	Pig iron/Scrap
Specification Standard	ASTM A-48 or IS 210: 1970
Grade	FG 200
Minimum Tensile Strength	200 MPa

BHN hardness	150 -160
Weight per receiver	2.320 tons

5.2 Chemical properties

Description	Required specification
Carbon	3.3% to 3.5%,
Silicon	1.6% to 2.0 %
Iron	94.5% to 95.5%

5.3 Tolerances

Description	Required specification	Proposition by Supplier
Outside diameter	± 2 %	
Ovality dimension	± 2 %	
Weight	± 2.5%	

Required sizes and Quantities

The cast iron receiver casting shall be as per the enclosed drawing. The quantities offered shall be mentioned by the bidder as per the prescribed format in Annexure – 5. In the table below the total quantities are mentioned.

Material	Weight (M tons)	Quantity (numbers)	Total quantity (M tons)
Grey Cast Iron receiver	2.320	750	1720