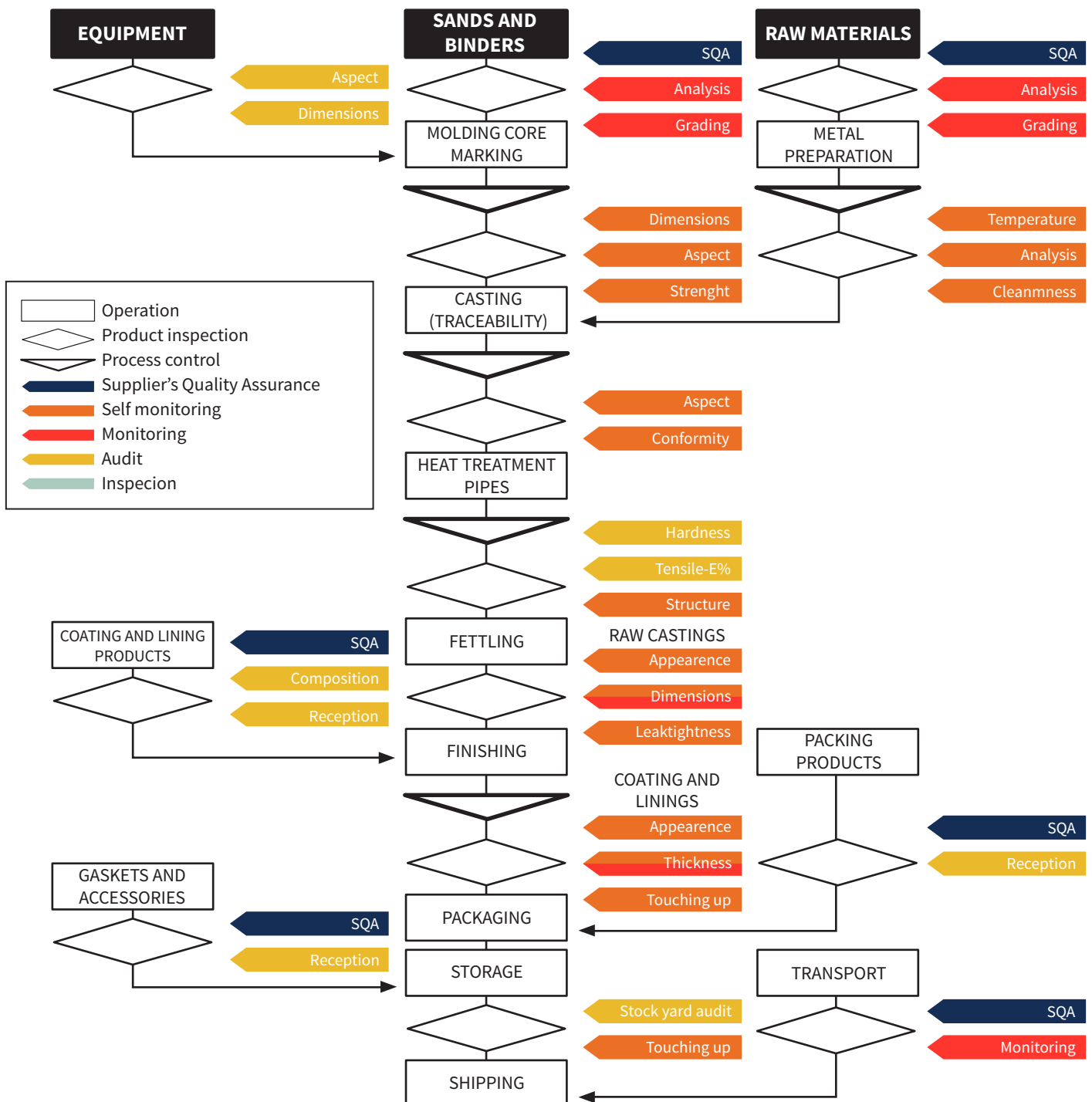


**Quality assurance**

Mafusa has instituted a quality control organization complying with Standard ISO 9001. Its objective is to provide customers with products meeting perfectly their stated requirements.

Achievement of quality is not simply a matter of inspection of finished products, but also involves establishment of an organization complying with specific regulations concerning:

- Manufacturing methods,
- Operating methods (establishing procedures, defining documents distribution),
- The responsibilities of the people involved, and which guarantee that all quality criteria are met at all stages of production.



## Quality control

The quality control and administration system has been certified as complying with Standard ISO 9001.

A reference work for the administering of quality control in production, this Standard also covers the quality aspects relating to the provision of materials, training, and customer contract handling.

On a practical daily basis the particular aims of the Q.C. organization are to:

- Check the consistency of incoming raw materials, constituents and other items necessary for the manufacture and usage of our products,
- Control the manufacturing process by formalizing our expertise, automation the processes and training of operatives whilst making constant improvements through analysis of the measurements made throughout the manufacturing cycle,
- Check at every stage of production that the products meet the specifications, thus providing early detection of any aberration, enabling it to be corrected,

The Q.C. Organization is founded on:

- Self-monitoring, which is the basis of the system in manufacture and consists in delegating monitoring of the results of their own work to operatives, within pre-established parameters.
- Auditing, which ensures in a systematic manner that everyone is obeying the rules laid down and checks on their efficacy. This applies to Mafusa and all its suppliers and sub-contractors, with whom it collaborates on quality assurance,
  - overall monitoring which on the basis of regular measurements, allows process and product performances to be quantified with respect to established objectives, and constitutes the basis of organized Quality Control management.
- Checking, if necessary, of particular properties of products, raw materials or constituents, not covered by the preceding arrangements.

## Inspection test plan

- **Raw material:** Analysis of scrap, pig iron, sand, cement bituminous paint etc.
- **Melting:** Spectro analysis of molten metal before and after Mg. Treatment.
- **Casting:** Weighing of each pipe before heat treatment.
- **Heat treatment:** Control micro structure of heat treated pipe (Amount of perlite, ferrite, cementite and formation of graphite).
- **Zinc Coating:** weighing of zinc load to conform to requirements which is minimum (200gm/m for EN545 – 2010).
- **Ring flattening:** Check ductility of pipe aside from micro test..
- **Test:** Frequency control of testing done according to requirement.
- **Mechanical Test:** Controls traction test (Tensile strength, elongation, elastic limit and Hardness to conform to ISO2531 / EN545.
- **Hydro Test:** Each pipe is hydro testes to comply to the required specification DN100 – 300 (50 Bars) DN350 – 600 (40 Bars) DN700 – 800 (32 Bars) if K-9, or 50 bar for C-50, 40 bar for C-40 and so on.
- **Socket/Spigot Control:** Each pipe's socket (inside diameter) and spigot is controlled by a regularly calibrated gauges.
- **Visual inspection:** Check physical appearance of every pipes to sort out good and bad pipes and pipes endorsed to Quality control for evaluation.
- **AC Dimensional Inspection:** Dimensional test randomly performed by QC to control outside diameter of pipes by circometer, thickness of the pipe by Ultrasonic, and inside diameter of socket by inside micrometer.
- **Cement Lining:**
  - Check visual appearance of cement lining
  - Check the thickness of cement lining (fresh cement) by a calibrated depth, gauge, and (dry cement) by permascope (non conductive thickness measurer)
  - Check weight of cement lining applied on pipes.
- **Bituminous Paint Coating:** Control thickness of coating to conform to the requirements of 50 microns minimum at 1 point and 70 microns minimum average.
- **Spigot Marking:** Check dimension of spigot markings to ensure it satisfies the requirement.
- **Delivery yard Inspection:** Check for appearance and possible defect which may occur during handling.

### Standard specifications for quality control

Mafusa products comply with European and international Standards.

#### For potable water

**ISO 9001** Model for Quality Assurance in Production, Installation and Servicing.

**ISO 2531 – 2009** Ductile Iron pipes, Fittings and Accessories for Pressure Pipelines

**EN 545** Ductile Iron Pipes, Fittings and Accessories and their joints for water pipelines. Requirements and test methods.

**ISO 4179 – 2005** Ductile Iron Pipes for pressure and Non pressure Pipelines-Centrifugal Cement Mortar Lining-General Requirements.

**ISO 8179 – 2004** Ductile Iron Pipes – External Zinc Coating.

**ISO 8180 – 2006** Ductile Iron Pipes – Polyethylene Sleeving.

**EN681 – 1 – 1996** Elastomeric seals Material requirements for pipe joint seals used in water and drainage applications.

#### For sewage application

**EN 598** Ductile Iron Pipes, fittings, accessories and their joints for sewage application – Requirements and test methods.

**ISO 4633 – 2002** Rubber Seals – joints Rings for water supply, Drainage and Sewerage Pipelines – Specs for materials.

**EN681 – 1 – 1996** Elastomeric seals Material requirements for pipe joint seals used in water and drainage applications.

Mafusa holds a number of certificates and endorsements which guarantee its ability to produce ductile iron castings in accordance with very severe quality assurance criteria.

These certificates are awarded by accountable outside organizations who regularly check their validity.