

Document Title: Procedure for Manufacture of Other Pipe Fittings

1.0 SCOPE

This procedure outlines the process to manufacture CS, SS and AS Reducers, Stub Ends, Elbows, Tees, Caps, Bends by conventional Die Punch Methods, from Seamless or Welded Pipe Lengths and ensure that all the manufactured fittings comply with stated requirements and are manufactured under controlled conditions.



Inspection Team

2.0 POLICY

These methods are used in cases where automation is not-practical.

3.0 METHOD

PRINCIPLE:

Hydraulic Press Machines are used with traditional Die Punches.

RAW MATERIALS (refer separate procedures for details):

Pipes are selected after Internal Inspections (Visual, Dimensions, Properties, etc) and cut to the required lengths, on Hacksaw or Plasma Cutting Machines. Starting Materials shall be free from burrs, cracks, nicks, gouges, waves, buckles, or other such surface defects that may impede the successful production of the fitting.

Heat Number punching (preferably low stress) is carried out on each cut length, to ensure traceability is maintained throughout the manufacturing process.

CRITICAL PARAMETERS:

- Formability of the material: it is necessary for the process to work properly and the fitting, does not break during the application of pressure;
- Friction at the interface: the friction between the die and the piece must be properly calibrated/lubricated;
- Machine parameters: these include times, pressures and movements of the axial cylinders that must be set correctly for the effective and efficient production of fittings.

ESSENTIAL VARIABLES:

- Pipe Wall Thickness – For Tee (One Higher Size Pipes are used); For Elbows and Stub-Ends (One Higher Schedule Pipes are used)
- Forming Velocity – Based on Hydraulic Press Machine
- Forming Temperature – Room/Ambient Temperature (Cold Formed) OR between 620°C and 980°C and Still Air Cooled (Hot Formed)
- Pressurizing Media – Hydraulic Cylinder

MANUFACTURING:

The Press Machine is primed to start manufacturing.

Machine Operator to ensure proper Machine conditions are set (Essential Variables) to avoid defects, etc.

The Pipe Cut lengths are loaded in the Die Punch and formed to the desired shapes and sizes, after application of Lubricant (Oil) on its inner/outer surface (as applicable).

Either Hot or Cold Forming Processes may be used.

For Elbows, Ball passing is usually carried out to ensure circularity of finished product.

At the end of the process, the semi-finished fittings can be extracted and directed, if necessary, to the subsequent processing phases.



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SAFETY:

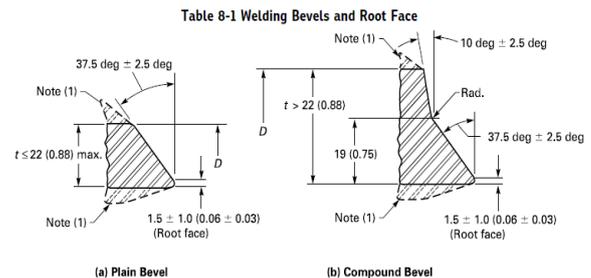
All required safety precautions shall be ensured (Safety Shoes, Safety Gloves, Safety Goggles, etc). Specific care to be taken since High Forces are involved.

SEMI-FINISHED INSPECTION:

The QC Engineer ensures that the first piece meets the Visual and Dimensional requirements of Semi-Finished products. He signs the Job Card (which is used for manufacturing details and clearance) as evidence of this inspection and manufacturing continues. More fittings may be inspected in case of large quantities at regular intervals, to ensure control on the process. Eventually the Job Card is signed off by the Machine Operator, after completion of all activities.

FINAL PROCESSES:

The semi-finished fittings are then forwarded to the Cutting / Machine Shop / Heat Treatment Section / NDT Section / Shot Blasting Section / Rust Preventive application Section / Paint Section, as applicable, for further processing. Final Beveling operations are generally carried out as indicated (ASME B16.25 / ASME B 16.9), but strictly as per the stated Dimensional Standard.



| Nominal Wall Thickness, t, mm (in.) | End Preparation |
|--------------------------------------|--|
| Less than x [Note (2)] | Cut square or slightly chamfer, at manufacturer's option (not illustrated) |
| x to 22 (0.88), inclusive [Note (2)] | Plain bevel as in illustration (a) above |
| More than 22 (0.88) | Compound bevel as in illustration (b) above |

GENERAL NOTE: In the illustrations, dimensions in parentheses are in inches; other dimensions are in millimeters.

NOTES:
 (1) See section 8 and Figure 8-1 for transition contours.
 (2) x = 5 mm (0.19 in.) for carbon steel or ferritic alloy steel and 3 mm (0.12 in.) for austenitic steel or nonferrous alloys.

TESTING (refer separate procedures for details):

Samples are drawn from the finished product for Laboratory Testing (Chemical, Mechanical, Hardness, as applicable, as per stated Material Standard).

FINAL INSPECTION (refer separate procedures for details):

Final Visual and Dimensional Inspections shall be completed by QC Engineer after Final Machining and Finishing Operations, as per the Standard QAP. Tolerances shall be as per the stated Dimensional Standards.

4.0 PROCESS VALIDATION

Visual and Dimensional (including Ovality, Outside Diameter, Wall Thickness [using Ultrasonic Thickness Gauge], Inside Diameter, Off Angle, Off Plane, Length, Height, etc) Inspections have resulted in compliances with the Standards. Material Testing (Chemical, Mechanical [Transverse / Longitudinal], Metallurgical, etc) have resulted in compliances with the Standards.

If the fittings are Hot Formed (between 620°C and 980°C) and cooled in Still Air, NO subsequent Heat Treatment is necessary, unless based on PO or Contractual requirements.

If the fittings have been Cold Formed, Heat Treatment (refer separate procedures for details) is MANDATORY to ensure acceptable metallurgy and hardness.

5.0 RESPONSIBILITY

This procedure is the responsibility of the Press Machine Operator and Production Engineer.

6.0 REFERENCES

- Machine Manufacturer's Manual
- Dimensional Standards – ASME, MSS SP
- Material Standards – ASME, ASTM, IS, DIN, EN



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