

SHREEJI ENGINEERS & CONSULTANTS

WORK INSTRUCTIONS

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Cutting of Plates by Plasma Cutting Machine

Section: WI-01

Purpose:

To describe the step-by-step procedure for cutting Stainless Steel Plates by Plasma Cutting Machine

Scope:

This document is applicable to cutting of Stainless Steel Plates by Plasma Cutting Machine to be carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: - Plasma Cutting Machine, Air Compressor

Tools / Consumables: Cutting Nozzles

Materials required: - Stainless Steel plates up to 30 mm thk.

Procedure:

1. Study the cutting requirements (as per customer's drawing) & markings.
2. Switch the Plasma Machine & Air Compressor 'ON'.
3. Ensure that the cutting nozzle is at least 3 mm from the cutting area.
4. Start the air flow to commence cutting.
5. After cutting operation is over, switch the Plasma machine & Air Compressor 'OFF'.

Precautions:

1. Check the Air Compressor pressure. Minimum required: 6 kg / cm² (g).
2. Check whether cutting nozzle properly tight.
3. Use safety goggles.
4. Use hand gloves, while unloading cut material from the machine.
5. Inform neighboring people about operation.

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Gas Cutting

WI - 02

Purpose: For cutting, parting of Sheets, Pipes & Structural items.

Scope: For Carbon Steel material.

Procedure:

1. Inspect the inlet connections, valves, and torch head for dirt, dust, oil, grease, or damaged parts.
2. Inspect the torch head. The tapered seating surface must be in good condition. If dents, burrs or burned seats are present, the seat must be resurfaced. If the torch is used with poor setting surface, backfire or back flash may occur and damage the equipment.
3. Select the required size and type of cutting tip. Inspect the tip seating surface for damage.
4. Insert the tip in the Cutting Torch head and tighten securely.
5. Adjust the regulator delivery pressures according to the size and type of tip being used.
6. Always purge out the cutting oxygen passages by opening the cutting oxygen valve at least five seconds before lighting the torch.
7. Open the fuel valve approximately one-half turn and ignite the gas.
8. Adjust oxygen and acetylene pressures to the specific levels recommended. Adjust the preheating flames to neutral (The two parts of this flame are the light blue inner cone and the darker blue to colorless outer cone.) with the cutting oxygen valve open.
9. Neutral Flame (Acetylene Oxygen in equal proportions): The flame has nicely defined inner cone which is light blue in colour. It is surrounded by outer flame envelop produce by the combination of Oxygen gases from the inner cone. This envelop is usually a much darker blue than the inner cone.
10. To start cutting, hold the torch with the nozzle perpendicular to the surface of the plate and with the flame inner cones not quite touching the plate surface, Center the nozzle over the edge of the plate.
11. As soon as a spot on the edge has been raised to bright red heat, slowly press the cutting oxygen valve lever and start cutting.
12. After finishing the cutting operation, first close all the valves on the cutting equipment and then close valves on cylinder.

Precautions:

1. Do not use the cutting torch if oil or grease is present. Grease or oil should never be used on regulator fittings because they can cause burning or explosion of lines.
2. Be sure work areas are free of flammable and combustible or explosive materials.
3. Always wear protective personal equipment.
4. Inform neighboring people about operation.

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Plate Bending

Section: WI – 03

Purpose:

To describe step-by-step procedure for bending Plates to carried out by M/S SHREEJI ENGINEERS & CONSULTANTS.

Scope:

This document is applicable for bending plates of less than or equal to 10 mm thickness x 2.0 mtrs width.

Equipment & Tool: Plate Bending Machine.

Procedure:

1. Study the requirement of bend as per drawing.
2. Prepare a template of required radius.
3. Pre punching of the said plate on both ends by hammering and check with template.
4. Unscrew driven spindle to accommodate plate & place the plate in between driver & driven spindle equally from both sides.
5. Now switch on the machine & let the plate pass through driven & driver spindle.
6. Now switch off the machine & check the plate radius achieved with template.
7. If radius is not achieved repeat the procedure by tightening the driven spindle till the radius is achieved.
8. After achieving radius unload the plate by removing driven spindle by unscrewing.

Precautions:

1. Check for persons standing in front / back side of the machine before switching ON.
2. Always clean the rollers before any new operation.
3. Before unloading the plate always make use of overhead crane or chain pulley block.

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TIG Welding (Stainless Steel)

Section: WI - 04

Purpose:

To describe step-by-step procedure for GTAW welding operation.

Scope:

This document is applicable to TIG welding operation carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Welding Rectifier, High Frequency Unit, Welding Inverter

Tools: Filler Wire

Materials required: - Stainless Steel & Carbon Steel plates.

Procedure:

1. Check Tungsten Electrode tip.
2. Check the gas setting of regulator and the setting proper current in the machine.

| Work Piece Thickness (mm) | Current range (Amp)Stainless Steel | Tungsten Electrode Dia (mm) | Max Argon Gas Flow Rate (ltr / min) |
|---------------------------|------------------------------------|-----------------------------|-------------------------------------|
| 1 - 3 | 40 - 50 | 2.5 | 4 |
| | 50 - 80 | | 6 |
| 3 - 8 | 80 - 120 | 2.5 - 3.15 | 7 |
| | 120 - 160 | | 8 |
| | 160 - 200 | 3.15 | 8 |
| | 200 - 300 | | 9 |
| 8 - 16 | 300 - 400 | 3.15 | 10 |

3. Switch the machine 'ON'.
4. Start the welding operation by manually feeding filler wire.
5. Switch the machine 'OFF'

Precautions:

1. Use welding screen while welding.
2. Use hand gloves during welding operation.
3. Check Tungsten rod utilization.

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MIG Welding

Section: WI - 05

Purpose: To describe step-by-step procedure for GTAW welding operation.

Scope: This document is applicable to MIG welding operation carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Welding Rectifier, High Frequency Unit, Welding Inverter

Tools: Filler Wire Spool, Argon & CO₂ Gas

Materials required: Stainless Steel & Carbon Steel plates.

Procedure:

1. Check Filler Wire tip.
2. Check the gas setting of regulator. Set the proper current in the machine by adjusting filler wire spool speed as per requirement.

| Current Ampere | Current Setup (Spool Speed) | | | Volt (V) | Inductance |
|----------------|-----------------------------|---------|---------|----------|------------|
| | Φ 1.0 | Φ 1.2 | Φ 1.6 | | |
| 60 | 10 – 12 | | | 17 – 18 | 3 – 5 |
| 80 | 13 – 15 | 8 – 10 | | 18 – 19 | 3 – 5 |
| 100 | 19 – 22 | 12 – 14 | 6 – 8 | 18 – 20 | 3 – 5 |
| 130 | 28 – 32 | 17 – 19 | 8 – 10 | 20 – 21 | 3 – 5 |
| 150 | 40 – 43 | 21 – 23 | 10 – 12 | 21 – 22 | 4 – 6 |
| 180 | 50 – 54 | 30 – 33 | 13 – 15 | 22 – 23 | 4 – 6 |
| 200 | 60 – 62 | 37 – 39 | 16 – 18 | 23 – 24 | 4 - 7 |
| 230 | 80 – 85 | 42 – 45 | 21 – 23 | 23 – 26 | 5 – 8 |
| 260 | 100 | 59 – 62 | 24 – 28 | 24 – 27 | 5 – 8 |
| 300 | | 80 – 85 | 30 – 34 | 26 – 30 | 5 – 8 |
| 330 | | 100 | 36 – 38 | 27 – 33 | 5 – 9 |
| 350 | | | 40 – 45 | 28 – 30 | 5 – 9 |
| 400 | | | 50 – 55 | 30 – 35 | 5 – 9 |
| 450 | | | 60 – 65 | 33 - 38 | 5 – 9 |

3. Switch the machine 'ON'.
4. Start the welding operation.
5. Switch the machine 'OFF'

Precautions:

1. Use welding screen while welding.
2. Use hand gloves during welding operation.
3. Check Tungsten rod utilization.

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Arc Welding (Carbon Steel & Stainless Steel)

Section: WI - 06

Purpose:

To describe step-by-step procedure for SMAW welding operation.

Scope:

This document is applicable to Arc welding operation carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: - Arc Welding Rectifier / Transformer

Tools: - Welding electrodes.

Materials required: - Stainless Steel & Carbon Steel plates.

Procedure:

1. Fit the appropriate rod inside the welding holder.
2. Switch the machine 'ON'
3. Set the current of the machine as per the table given below:

| Size of rod (mm) | Current range Carbon Steel (Ampere) | Current range Stainless Steel (Ampere) |
|------------------|-------------------------------------|--|
| 5.00 | 190-250 | 130-150 |
| 4.00 | 140-190 | 100-120 |
| 3.15 | 100-140 | 70-100 |
| 2.50 | 60-90 | 50-70 |

4. Start the welding operation.
5. Switch the machine 'OFF'

Precautions:

1. Use welding screen while welding.
2. Use hand gloves during welding operation.

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Grinding Machine

Section: WI-07

Purpose:

To describe the step-by-step procedure for cutting & grinding of Stainless Steel & Carbon Steel material by Grinding Machine

Scope:

This document is applicable to cutting of Stainless Steel Plates by grinding machine to be carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Grinding Machine

Tools / Consumables: Abrasive Cutting wheels.

Materials required: Stainless Steel plates.

Procedure:

1. Study the cutting requirements (as per customer's drawing) & markings.
2. Switch the grinding machine 'ON'.
3. After cutting operation is over, switch the machine 'OFF'.

Precautions:

1. Check carbon brush.
2. Check whether cutting wheel is properly tight.
3. Use safety goggles.
4. Use hand gloves, while unloading cut material.
5. Inform neighboring people about operation.

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Turning

Section: WI-08

Purpose:

To ensure proper & safe use of the Lathe Machine with the right sequence of operation to generate goods of the required dimensions and finish as per Sketch / drawings.

Scope:

It covers the operation of machining of various Stainless Steel, Carbon Steel materials on the Lathe machine which is a machine used for turning / parting on the bars, circles, rings.

Equipment Required: Lathe Machine/s

Tools: Drill, Side tool, Parting tool, Boring tool and threading tool.

Material: Carbon Steel, Stainless Steel

1. Turning cylindrical Jobs & Taper Jobs.
2. Boring cylindrical & Taper Jobs.
3. Facing of surface using a face plate or angle plate.
4. Drilling, reaming & tapping of holes.
5. Cutting screw internal & external of any desired form & pitch.

Procedure:

1. Ensure the main power is turned off when doing Total Preventive Maintenance.
2. Check alignment of lathe centers to avoid tapers.
3. Secure / fasten the part in the chuck.
4. Make sure cutting tools are centered and securely fastened.
5. Adjust lathe controls to set rotation speed, feed rates, and depth of cuts.
6. Turn hand wheels to feed the tool to the work piece or engage an automatic feed.
7. Direct the flow of coolant and remove chips.
8. Facing, Turning, Drilling, Boring, Knurling, screw thread operations can be carried out using proper tools, attachment & fixtures.
9. Mark reference lines on the workpiece with a scribe (tool) when required.
10. Use proper measuring instruments like Vernier Calipers, Micrometers, Thread Gauges, and Bore Gauges to check dimensional accuracy of the work piece/s.
11. Clean and Oil the machine daily at points indicated and check oil level regularly.

Precautions:

1. Change worn out tools
2. Make sure cutting tools are used properly and for their intended application.
3. Keep the machine and adjacent area clean, return tools to the proper location after use.
4. Never leave a running (spindle turning) lathe unattended.
5. Make sure that the forward/ reverse lever is fully disengaged before using the chuck wrench.
6. Always let the chuck come to a complete stop before touching the part or the chuck.
7. Never attempt to remove chips by hand, turn off the lathe and use a chip hook or a brush. Unattended

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Drilling

Section: WI-09

Purpose: To describe step-by-step procedure for drilling operation.

Scope:

This document covers the operation of drilling carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Drill machine

Tools: Drills of various sizes, Collet for holding drill.

Material: Carbon Steel, Stainless Steel material of various shapes and sizes.

Procedure:

1. Select the proper cutting speed and feed to obtain required finish.
2. Select particular drill as per requirements.
3. Set the machine as per punch marks on the part to be drilled.
4. Switch the machine 'ON'.
5. Carry out the operation of drilling.
6. Switch the machine 'OFF'.
7. Use proper measuring instruments like Vernier Calipers to check dimensional accuracy of the work pieces.
8. Clean & oil the machine daily at points indicated and check oil level regularly.
9. Use the proper soluble cutting oil.

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Bench Grinder

Section: WI-10

Purpose: To describe the use of Bench Grinding Machine.

Scope: This document is applicable to sharpen HSS tools & Tungsten Electrode by use of Bench Grinder to be carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Bench Grinder

Tools: 7" Grinding Wheel

Material: HSS Tools, Tungsten Electrode

Procedure:

1. Always place a tray large enough to fit the tool piece filled with water in front of the bench grinder.
2. Turn the Bench Grinder on.
3. Once the GRINDING WHEEL has reached full speed, bring the workpiece up to the wheel gently and without jarring.
4. Use the TOOL REST to steady the work piece.
5. The work piece will quickly become heated. Frequently quench the work piece in water. If the metal becomes heated so much that it gets blue-colored, it will be too soft to be useful. You must grind off the part that is colored, cool the work piece and start again.
6. Turn off grinder and wait until comes to a complete stop. Never stick an object into the wheel to stop the grinder quicker. Let it stop on its own.

GRINDING STONE:

1. To replace grinding wheel remove outer guard by removing the screws.
2. Remove hexagonal nut using appropriate wrench.
3. Remove and replace stone with a proper size stone of choice insuring that the speed rating of the stone is equal to or greater than the machine nameplate.
4. Inspect the wheels for a hairline crack before using. DO NOT USE A CRACKED WHEEL."

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Flexible Shaft Grinder

Section: WI-11

Purpose: To describe the use of Flexible Shaft Grinding Machine.

Scope: This document is applicable for grinding, polishing of Stainless Steel equipments by use of Flexible Shaft Grinding Machine to be carried out at M/S SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Flexible Shaft Grinder

Tools: Grinding Wheel, Flap Wheel, Buffing Wheel

Material: Stainless Steel

Procedure:

1. Before commencing grinding, allow the grinding wheel to run at operating speed for at least one minute. Do not stand directly in front of a Grinding Wheel when it is first started. Do not use a wheel that vibrates.
2. When commencing a grinding operation, bring the object into contact with the grinding wheel slowly and smoothly avoiding impact or bumping motions.
3. In using the flexible shaft, keep it as straight as possible. Sharp bends will cause excessive wear on the inside of the housing and shorten the useful life of both the shaft and housing.
4. Apply moderate pressure slowly and evenly.
5. Occasionally if a new wheel is cracked or flawed, it is likely to shatter as soon as it is used. New wheels should be visually checked and given a test before being fixed to the spindle.
6. Disconnect power before changing tools/accessories or inspecting or cleaning the machine.

LUBRICATION OF FLEXIBLE SHAFT:

The following procedure for lubrication is recommended:

1. Lay the machine in a location free of dirt and sand.
2. Take some grease, in the palm of one hand and with the other hand guide the Flexible shaft through hand containing lubricant into the flexible housing. This method will result in a thin uniform film covering the entire shaft. Excessive greasing will cause vibration. Remove surplus grease from the shaft.
3. The flexible shaft should be re-lubricated after each 50 hours of use.

INSTALLING FLEXIBLE SHAFT AND HOUSING TO THE MOTOR:

1. Pull the threaded end of the flexible shaft out of the housing about 12 inches. Screw the flexible shaft into the motor shaft. Screw the flexible housing onto the motor cover.
2. On initial running after regreasing or on fitment of new inner shaft, the inner shaft will vibrate heavily for few minutes before settling to run smoothly. Hence run it without the tool holder attachment till the initial vibration settles down and then fix the tool holders.
3. The housing should be tightened with a wrench and always kept tight on the motor cover to prevent wearing of the threads on both parts.

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Title: Hack Saw Cutting

Section: WI - 12

Purpose: To describe step-by-step procedure for cutting Bars / Rods, Angles, Channels by Hack Saw Cutting Machine.

Scope: This document is applicable for Hack Saw Cutting operation is carried out at SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Hack saw cutting Machine.

Tools: Hack Saw Blade.

Materials required: Carbon Steel, Stainless Steel Rods, Channel, Angles.

Procedure:

1. Check the saw thoroughly before using it.
2. Raise the saw arm as far as possible.
3. Place the work piece in the vice, set the length bar as required and clamp the work piece securely.
4. Turn on the coolant supply tap and direct the coolant nozzle towards the area of the work piece that will be cut.
5. Connect the machine to the mains power supply. Start the machine and the arm will automatically lower and start cutting.
6. When sawing is completed, switch off the machine, raise blade and remove work piece.
7. Replacing the saw blade:
8. Disconnect the machine from the power supply.
9. Loosen the two screws, holding the fixed plate on.
10. Undo the two locking nuts, and release the tension in the blade.
11. Undo the two blade retaining screws, and remove the blade.
12. Fitting the new blade is the reverse of the procedure in paragraph.

Blade tension:

1. Test the blade tension by flicking the blade. The blade should make a sharp pinging sound if it is correctly adjusted.
2. To adjust the blade tension, turn the lock nuts. Do not over tighten.

Precautions:

1. Never raise the blade when the machine is running.
2. Do not over tighten the blade.

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Dye Penetrate Test

Section: WI - 13

Purpose:

To describe step-by-step procedure for Dye Penetrate Test.

Scope:

This document is applicable for Dye Penetrate Test operation is carried out at SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Air Compressor.

Tools: Dye (contain of Halogen & Sulfur less than 25 PPM), Cleaner developer Cotton Waste.

Procedure:

1. Surface to be examined will be ground, machined to remove any irregularities, which can mask defects or give spurious indications.
2. Surface to be examined will then be cleared free from dirt, grease, dust etc. with detergent, de-scaling solutions (where required). Generally, use of acetone will be made for surface cleaning,
3. Cleaned surface will, be allowed to dry for 20-30 minutes to make sure that cleaning solvents have evaporated.
4. Penetrant will be applied by spraying on to the dry surface of the weld (Temperature of surface will be 16 degree to 52 degree).
5. Then the penetrant is allowed to penetrate in to the defects for 15 minutes at 16 to 52 degrees.
6. After this, excess penetrant is wiped off with a clean dry cloth using acetone.
7. A developer is applied by spraying on to this surface to form a sufficient coating film.
8. The surface is allowed to settle for about 10 to 20 minutes before checking.
9. Then the discontinuities are observed in the form of bleeding of the dye penetrant, which is gradually bright red in colour.
10. Such defects are repaired as per accepted method of repairs and the joint/surface is checked for defects by dye penetrant test as given above.
11. Post cleaning of surface after the testing with Acetone and cotton cloth.

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Pneumatic Test

Section: WI - 14

Purpose:

To describe step-by-step procedure for Pneumatic Test.

Scope:

This document is applicable for Pneumatic Test operation is carried out at SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Air Compressor.

Tools: Calibrated Pressure Gauge.

Procedure:

1. Testing of components like Jacketed Pipes, Pad Plates etc. shall be carried out as per the requirements of ASME Sec. III (ND) and Sec. V.
2. Clean, filtered oil and moisture free air shall be used in Pneumatic Testing.
3. Maximum air pressure to be applied inside the equipment will not be greater than $1.5 \text{ kg/cm}^2 \text{ (g)}$ to $2.0 \text{ kg/cm}^2 \text{ (g)}$.
4. Tell tale holes shall be plugged by welding and checked by dye penetrant test, after completion of test.

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Hydrostatic Test of Pressure Vessels

Section: WI - 15

Purpose: To describe step-by-step procedure for Hydro Test.

Scope: This document is applicable for Hydro Test operation is carried out at SHREEJI ENGINEERS & CONSULTANTS.

Equipment: Motorized Hydro test Pump, Manual operating Hydro test Pump.

Tools: Calibrated Pressure Gauge.

Procedure:

1. The vessels/equipments shall be taken up for hydrostatic test only after completion of all fabrication & NDE.
2. The vessels/equipments shall be positioned vertically/horizontally as the case may be with opening at high points for venting & a low point for draining.
3. Water shall be filled from top nozzle and closed with test blank. Test blank shall be with nipple, square bar, pressure gauge and pipe connection for venting.
4. The vessel and the connection shall be properly vented before the test pressure is applied to prevent the formation of air pockets.
5. The pressure in the vessel shall be gradually increased to a value of 50% of the specified test pressure there after the pressure shall be increased in the stage of app.10% of the specified test pressure until the test pressure is reached.
6. When test pressure is reached, close the valve connected to the vessel / pressure gauge. Open the bypass valve on the pump and then switch off the pump to stop pumping. Remove the hose pipe connected between the equipment and the pump. Hold for 30 min (as specified in spec) and observe the vessel from distance.
7. When in case of using a manual hydro testing pump, keep pumping manually till the test pressure is reached. Then close the valve connected to the vessel / pressure gauge. Remove the hose pipe connected between the equipment and the pump.
8. Reduce the test pressure to above design pressure and inspect all connections for leakage.
9. If any leakage is observed through gasket connection, repeat the test after depressurize the vessel & tighten the studs / nuts.
10. If any leakage is observed from weld or parent metal, drain the water, repair the leak and repeat the test.

IMPORTANT SAFETY POINTS IN HYDROTEST:

1. Drain the vessel only when top out let is kept open.
2. The indication range of the pressure gauge shall not be less than 1.5 times & not more than 4 times of the test pressure.
3. Whenever possible use minimum 2 pressure gauges for any hydro test.
4. Never pressurize any vessel above test pressure.

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