How to achieve Hight-difinition cutting effect --HPR X-mark

The following reference guide offers several solutions to help improve cut quality.

➔ Consider the following factors when evaluating plasma cut quality.

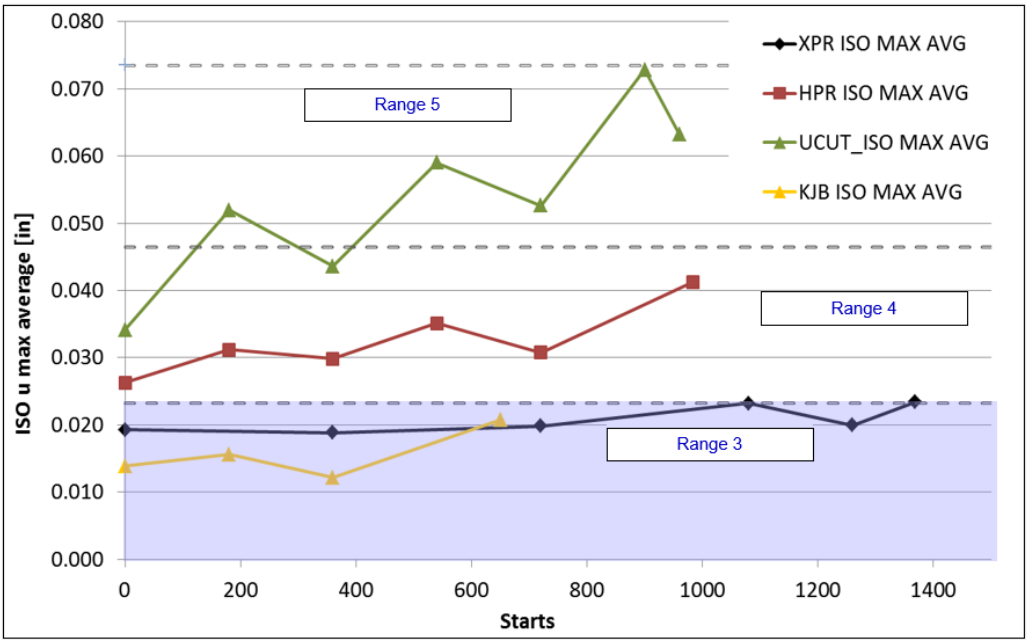
- ◆ The machine factors
    1. Machine stability and machine flatness;
    2. Grounding of the machine;
    3. Stability of the material table support plate-to ensure the stability of the workpiece;
- ◆ Plasma Cutting System
    4. Plasma power supply;
    5. Plasma torch installation;
    6. Matching of wearing parts;
    7. Gas purity and pressure;
- ◆ Process variables
    8. Cutting Speed;
    9. Cutting Height →Set arc-voltage;
- ◆ External variables
    1. Material variability;
    2. Operator experience;

All of these factors can affect the appearance of a cut.

In summary: We provide twelve steps for commissioning.

Cutting quality: reference standard

The following chart: The standard range of high-difinition cutting, the horizontal coordinate is the number of perforations, and the vertical coordinate is a reasonable range value;



The quality standard of HPR series cutting is Range-4, including deviations and angle;

	ISO 9013:2002(E) Specs				Deviation values in inches					
					XPR ISO		HPR ISO			
Material Thickness	Range 1		Range 2		Range 3		Range 4		Range 5	
inch	Deviation	Angle	Deviation	Angle	Deviation	Angle	Deviation	Angle	Deviation	Angle
.060"	0.0021	2.6	0.0063	7.51	0.0163	18.81	0.0327	34.26	0.0493	45.79
.135"	0.0024	1.2	0.0069	3.52	0.0171	8.73	0.0342	17.07	0.0520	25.01
1/4"	0.0027	0.8	0.0077	2.16	0.0182	5.14	0.0365	10.20	0.0560	15.44
3/8"	0.0031	0.5	0.0085	1.49	0.0195	3.40	0.0390	6.79	0.0604	10.44
1/2"	0.0035	0.5	0.0094	1.28	0.0207	2.82	0.0415	5.63	0.0647	8.74
3/4"	0.0042	0.4	0.0112	0.95	0.0232	1.98	0.0465	3.96	0.0735	6.25
1"	0.0050	0.3	0.0129	0.84	0.0257	1.67	0.0515	3.34	0.0822	5.33
1-1/8"	0.0053	0.3	0.0138	0.78	0.0270	1.54	0.0540	3.07	0.0866	4.92
1-1/4"	0.0057	0.3	0.0147	0.74	0.0282	1.43	0.0565	2.86	0.0910	4.60
1-1/2"	0.0065	0.3	0.0164	0.68	0.0307	1.27	0.0615	2.55	0.0997	4.13
1-3/4"	0.0072	0.3	0.0182	0.65	0.0332	1.20	0.0665	2.39	0.1085	3.90
2"	0.0080	0.2	0.0199	0.62	0.0357	1.11	0.0715	2.22	0.1172	3.64

	ISO 9013:2002(E) Specs				Deviation values in mm					
Material Thickness材料厚	Range 1范围1		Range 2		Range 3		Range 4		Range 5	
mm毫米	Deviation上下偏差	Angle角度	Deviation	Angle	Deviation	Angle	Deviation	Angle	Deviation	Angle
1.5	0.0545	2.6	0.1605	7.62	0.4150	19.08	0.8300	34.67	1.2525	46.23
3.0	0.0590	1.4	0.1710	4.08	0.4300	10.16	0.8600	19.71	1.3050	28.54
6.0	0.0680	0.7	0.1920	2.04	0.4600	4.87	0.9200	9.67	1.4100	14.63
8.0	0.0740	0.6	0.2060	1.74	0.4800	4.04	0.9600	8.04	1.4800	12.28
10.0	0.0800	0.5	0.2200	1.43	0.5000	3.25	1.0000	6.48	1.5500	9.99
12	0.0860	0.5	0.2340	1.34	0.5200	2.98	1.0400	5.94	1.6200	9.20
15	0.0950	0.4	0.2550	1.12	0.5500	2.42	1.1000	4.84	1.7250	7.56
18	0.1040	0.4	0.2760	0.99	0.5800	2.08	1.1600	4.15	1.8300	6.52
25	0.1250	0.3	0.3250	0.85	0.6500	1.69	1.3000	3.38	2.0750	5.39
30	0.1400	0.3	0.3600	0.76	0.7000	1.49	1.4000	2.97	2.2500	4.76
40	0.1700	0.3	0.4300	0.67	0.8000	1.24	1.6000	2.48	2.6000	4.02
50	0.2000	0.2	0.5000	0.62	0.9000	1.12	1.8000	2.24	2.9500	3.67

Basic steps to improve cut quality : --12 Steps

➔ Step→1: Adjust the support legs of the machine;

Each support leg of the machine must play a supporting role, and it is not allowed to float;

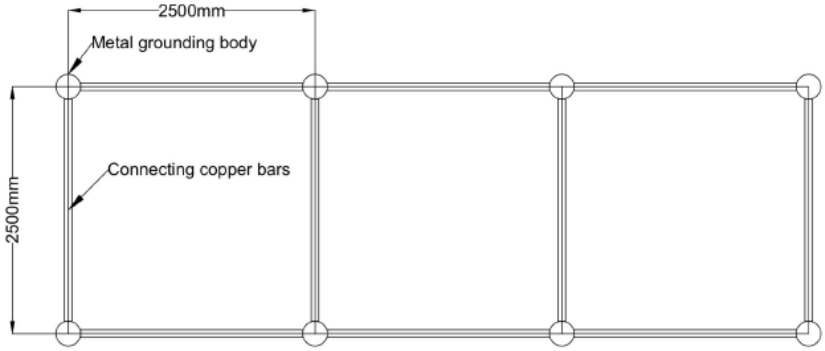
Adjust the overall flatness of the machine at about 1mm;

➔ Step→ 2: Grounding of machine and plasma;

In order to ensure the continuous output of the plasma power and to avoid the machine from high frequency interference

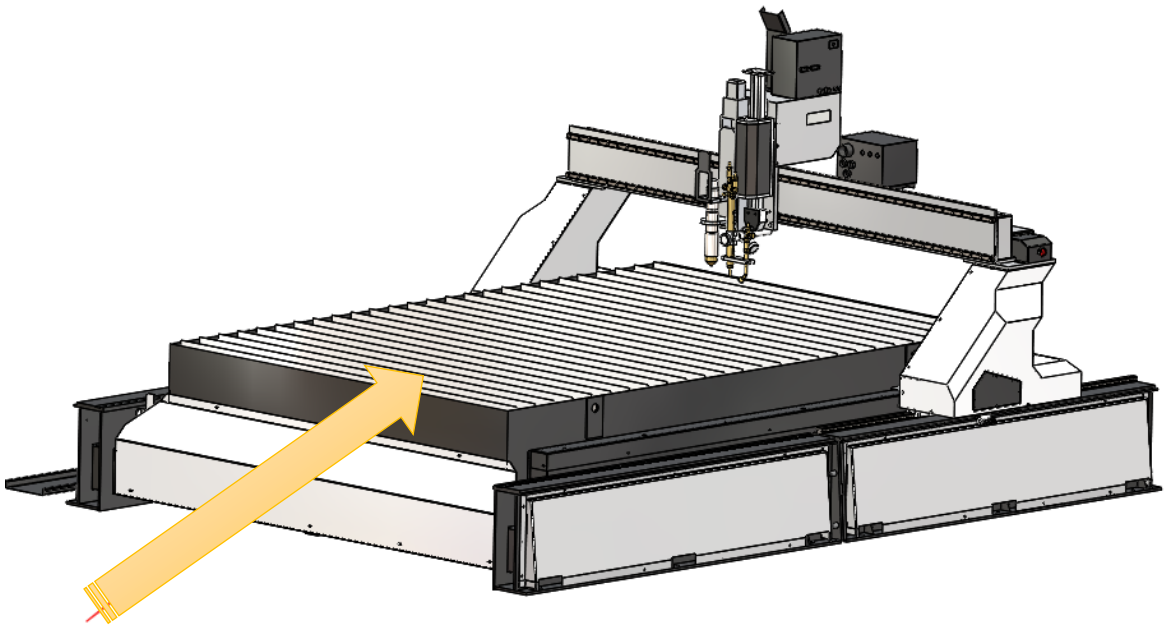
Specific operation method: refer to ground Solution;

Ground grid production diagram:



➔ Step→3: Stability of workpiece discharge table;

If the deformed flatness of the steel plate is severely damaged, the workpiece needs to be repaired. If the support of the material table is unstable, the support plate needs to be repaired to ensure that the workpiece is stable;

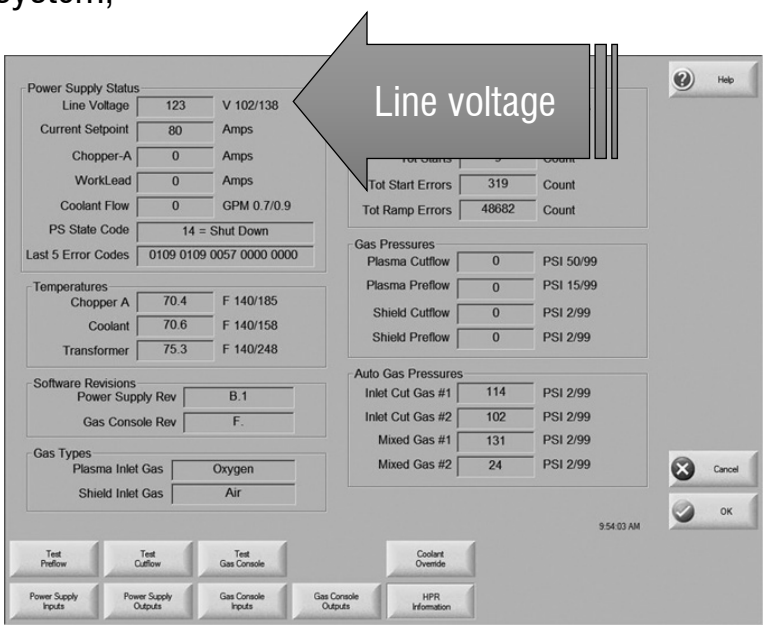


➔ Step→3:Check plasma supply system;

Check if the plasma supply voltage is stable for a long time;

Check whether the power supply coolant is normal;

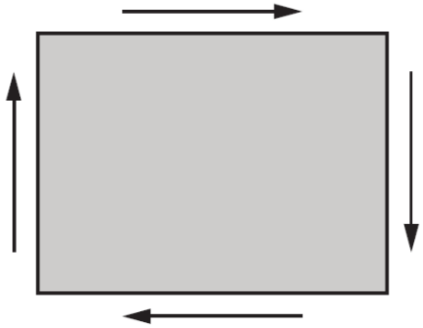
Refer to the plasma power supply manual to check the plasma power daily;



➔ Step→5： Is the plasma arc cutting in the appropriate direction? Need to be considered when nesting;

- ◆ The squarest cut angles are always on the right side in relation to the forward motion of the torch.
- ◆ Make sure that the direction of the cut is correct.
- ◆ Adjust the cutting direction, if necessary. The plasma arc typically spins clockwise with standard consumables

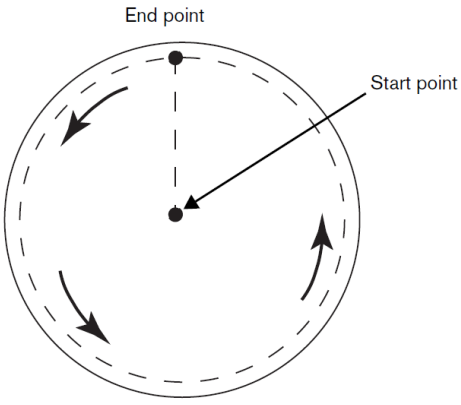
Contour



- ◆ The torch travels clockwise.
- ◆ The good side of the cut is to the right side of the torch, as it travels forward.

Internal feature (hole)

- ◆ Torch travels counterclockwise.



- ◆ Good side of the cut is to the right side of the torch as it travels forward.

➔ Step→6: Was the correct process selected for the material and thickness?

Refer to the cut charts. On the CNC, choose the Cut Chart soft key on the Main screen to view the cut chart for the selected torch type, material, and thickness.

Follow the specifications in the cut charts. →The following information is in the Hypertherm Plasma instruction manual and system description.

- Select the appropriate process for:
  - Material type
  - Material thickness
  - Desired cut quality
  - Productivity goals
- Select the correct plasma and shield gas.
- Select correct parameters for:
  - Gas pressures (or flow rates)
  - Cut height and arc voltage
  - Cutting speed
- Make sure that the correct consumables are being used, and make sure that the part numbers are correct.

 Generally, lower amperage processes offer better angularity and surface finish. However, cutting speeds are slower and dross levels are higher.

➔ Step→7: Are the consumables worn?

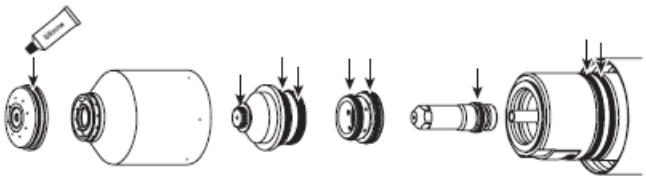
- ◆ Inspect consumables for wear.
- ◆ Replace worn consumables.
- ◆ Always replace the nozzle and electrode at the same time.
- ◆ Avoid over-lubricating O-rings.

Use genuine Hypertherm consumables to maximize cutting performance.

Install consumables

Check the consumable parts daily for wear before cutting. Before removing consumables, bring the torch to the edge of the cutting table, with the torch lifter raised to its highest point to prevent the consumables from dropping into the water of the water table.

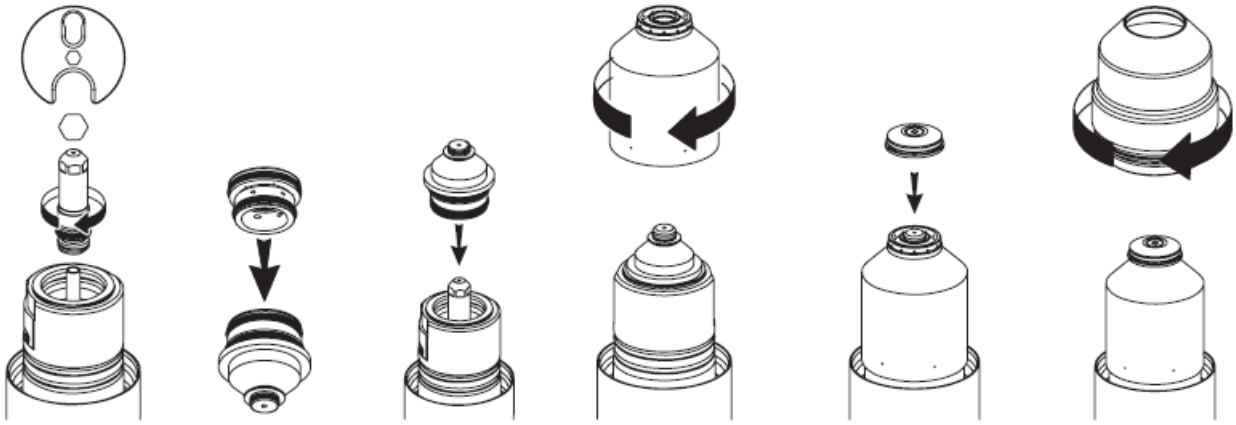
Note: Do not overtighten parts! Only tighten until mating parts are seated.



Apply a thin film of silicone lubricant on each o-ring. The o-ring should look shiny, but there should not be any excess or built-up grease.

Wipe the internal and external surfaces of the torch with a clean cloth or paper towel.

Tool: 104119



1. Install the electrode
2. Install the swirl ring
3. Install the nozzle and swirl ring
4. Install the nozzle retaining cap
5. Install the shield
6. Install the shield cap

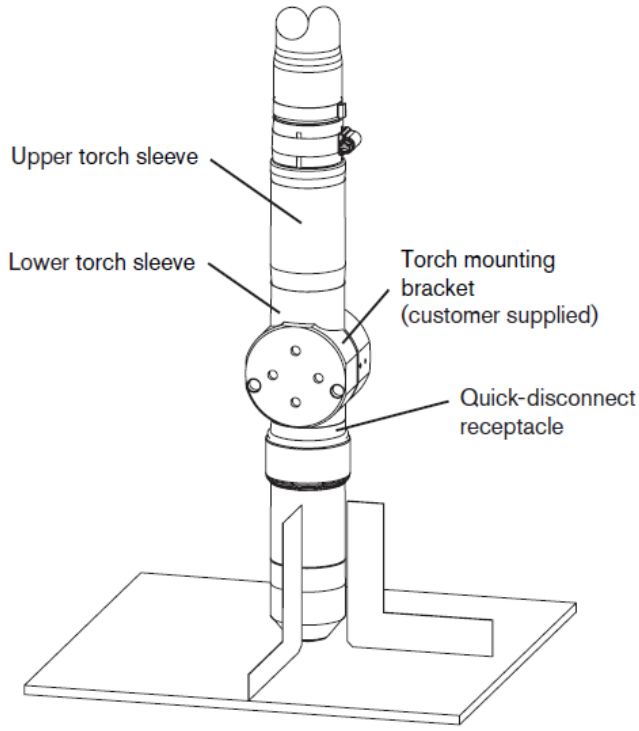
➔ Step→8: Is the torch square to the workpiece?

- ◆ Level the workpiece.
- ◆ Square the torch to the workpiece, both from the front and side of the torch.

Examine the material to see if it is bent or warped. In extreme cases this limitation cannot be corrected.

Torch mounting and alignment

Mounting the torch



Installation

1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch below the mounting bracket, so that the bracket is around the lower portion of the torch sleeve but not touching the torch quick-disconnect.
3. Tighten the securing screws.

Note: The bracket should be as low on the torch sleeve as possible to minimize vibration at the tip of the torch.

Torch alignment

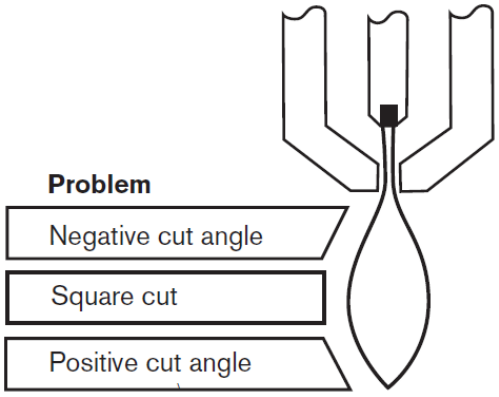
To align the torch at right angles to the workpiece, use a square. See figure above.

➔ Step→9: Is the cut height set at the proper height?

- ◆ Adjust the cut height to the correct setting.
- ◆ If you are using arc voltage control, adjust the voltage.

As consumable parts wear, arc voltage settings need continual adjustment to maintain cut height.

- ◆ Cut height can impact angularity.
  - ● Negative cut angle: torch too low; increase cut height.
  - ● Positive cut angle: torch too high; decrease cut height.



Problem	Cause	Solution
Negative cut angle	The torch is too low.	Increase arc voltage to raise the torch.
Square cut		
Positive cut angle	The torch is too high.	Decrease arc voltage to lower the torch.

A slight variation in cut angles can be normal if the variation is within tolerance.

➔ Step→10：Is the cutting speed set too fast or too slow?

- ◆ Adjust the cutting speed as needed.

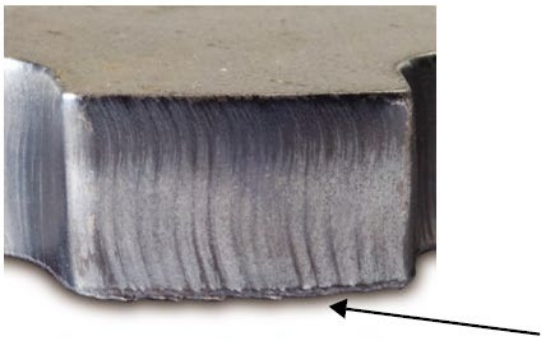
  Cutting speed can also impact your dross levels.

- ◆ High-speed dross: The cutting speed is too fast and the arc lags behind. Reduce the cutting speed.
- ◆ Low-speed dross: The cutting speed is too slow and the arc shoots ahead. Increase the cutting speed.
- ◆ Top spatter: The cutting speed is too fast. Reduce the cutting speed.

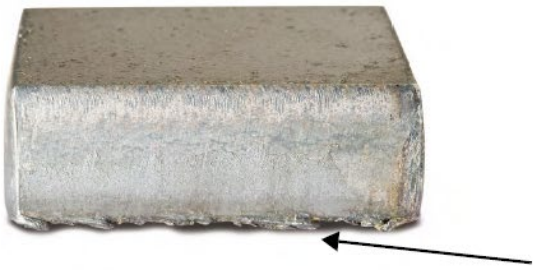
In addition to speed, both material chemistry and surface finish can impact dross levels. When the workpiece heats up, more dross can form on subsequent cuts.

Dross

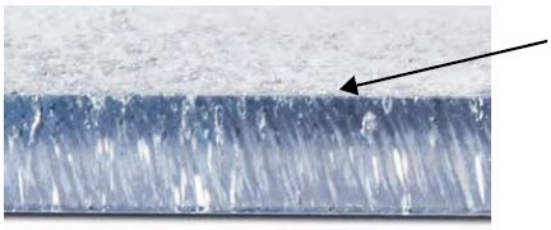
High-speed dross: A small, linear bead of molten material attaches and hardens along the bottom edge of the cut. In addition, S-shaped lag lines are present; dross is difficult to remove and requires grinding.



Low-speed dross: A bubbly or globular accumulation of molten material attaches and hardens along the bottom edge of the cut. In addition, vertical lag lines may be present; dross is easy to remove and flakes off in large chunks.



Top spatter: A light spatter of molten material collects on the top edges of the cut. Usually, this spatter is inconsequential and is most common with air plasma.



➔ Step→11： Are there problems with the gas delivery system?

- ◆ □ Identify and repair any leaks or restrictions.
- ◆ □ Use correctly sized regulators and gas lines.
- ◆ □ Use pure, high-quality gas.
- ◆ □ If a manual purge is required, confirm that the purging cycle was completed.

System gas requirements

Gas quality and pressure requirements			
Gas type	**Quality**	**Pressure +/- 10%**	**Flow rate**
O_2 oxygen	99.5% pure Clean, dry, oil-free	793 kPa / 8 bar 115 psi	4250 l/h 150 scfh
N_2 nitrogen	99.99% pure Clean, dry, oil-free	793 kPa / 8 bar 115 psi	7080 l/h 250 scfh
Air	* Clean, dry, oil-free per ISO 8573-1 Class 1.4.2	793 kPa / 8 bar 115 psi	7080 l/h 250 scfh
H35 argon-hydrogen	99.995% pure (H35 = 65% Argon, 35% Hydrogen)	793 kPa / 8 bar 115 psi	4250 l/h 150 scfh
F5 nitrogen-hydrogen	99.98% pure (F5 = 95% Nitrogen, 5% Hydrogen)	793 kPa / 8 bar 115 psi	4250 l/h 150 scfh
Ar argon	99.99% pure Clean, dry, oil-free	793 kPa / 8 bar 115 psi	4250 l/h 150 scfh

* ISO standard 8573-1 Class 1.4.2 requirements are:

- Particulates – no more than 100 particles per cubic meter of air at a Size of 0.1 to 0.5 microns in the largest dimension and 1 particle per cubic meter of air at a Size of 0.5 to 5.0 microns in the largest dimension.
- Water – the pressure dewpoint of the humidity must be less than or equal to 3°C (37.4°F).
- Oil – the concentration of oil can be no more than 0.1 mg per cubic meter of air.

➔ Step→12: Is there torch vibration?

◆ Make sure that the torch is tightly attached to the table gantry.