Study of Sizing and Standardization of Low Pressure Gas Welding Nozzles

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Abstract - *The research paper tiled Study of sizing and Standardization of Gas welding tip and nozzle used in LP welding deals in depth analysis of sizing of welding tips and nozzle used in low pressure gas welding. The topic is in existence with the invention and use of welding tip and nozzle. The research paper give a brief study of the welding tip and nozzles, problem and solution attached with. The author is firmly believed that standardization in sizing of welding tip/nozzle brings uniformity in design and better understanding of the subject.*

Key Words: **Low pressure, Tip, Nozzle, Gauge, Drill Hole**

INTRODUCTION

The gas welding is of two types LP (Low Pressure) and HP (High Pressure). The pressure of acetylene used is below atmospheric (0.1 bar) for low pressure welding. The pressure of acetylene is above atmospheric maximum up to 2 bars for high pressure welding [1].

The low pressure gas welding system consists of acetylene generator having hydraulic back pressure valve, oxygen cylinder, pressure regulators for both the gases, welding torch, welding tip (Nozzle), hoses for both the gases etc. Both the gases inter in the welding torch and mix in the chamber of welding torch. The construction is different for low pressure and high pressure welding. The welding tip (nozzle) is the end part of welding torch. It consists of an opening through which the gases pass just prior to ignition and combustion. The welding tip (nozzle) is of solid nozzle or two piece nozzle. The single piece or solid tip attached to welding torch is generally used for heating application.

Use of LP Welding -

The low pressure welding very common in automotive repair shops in India. The automotive repair consists of body parts weld where tag and lap welding is done on the different parts of body vehicle. The Low Pressure gas welding is used for major work such as to remove, reshape and refit floors, doors, body panels, fenders, wheel box etc. The minor repair works performed on auto body are beat out, cut open repair. Other than automotive repair low pressure gas welding is also used for joining of thin ferrous and non ferrous materials, air craft industries and sheet metal fabrication plant. [2]

The low pressure welding is generally used in automotive repair shop for welding 16 Gauge to 22 Gauge. The welder generally measures and works on gauge thickness and not in millimeter. The Gauge thickness is different for different material as 16 Gauge (1/16 Inch) 0.0626 Inch or 1.59mm for Stainless sheet, 0.0635 Inch or 1.61mm for Galvanized sheet, 0.0598 Inch or 1.52mm for Sheet Metal and 0.0508 Inch or 1.29mm for Aluminum. Similarly 22 Gauge (1/32 Inch) is 0.0312 Inch or 0.79mm for Stainless sheet, 0.03336 Inch or 0.85mm for Galvanized sheet, 0.0299 Inch or 0.76mm for Sheet Metal and 0.0253 Inch or 0.64mm for Aluminum. For welding 16 to 18 Gauge sheets 2No, 18 to 20 Gauge 1No and 20 to 22 Gauge and more 0 No nozzle is used.

Sizing and Standardization of Tip –

The welding tip or nozzle size is selected as per the tip orifice size. The nozzle tip orifice size of welding thickness is equivalent to the wire drill size diameter. It is taken as wire drill, decimal inch and metric equivalent. It is very difficult to select the welding tip/nozzle with compare to the drill size diameter. Table no.1 shows the comparison of tip no. of leading European, USA and Australian manufacturer provided by web site bikesmithdesign.com [3]. The table shows that there is very less similarity of specification with the other manufacturer. If we start comparing Victor a US manufacturer which starts with first welding tip size #000 with a 0.559 mm hole size with the Messer a European manufacturer starts its first welding tip size from #00 with a 0.343 mm hole size. Different manufacturer give different nozzle sizes no. and no uniformity is maintain by manufacturers. So there is no uniformity in the specification.

Table 2 shows the operational and Parameter data of Welding Tip/ Nozzle. These comparisons are of specifications of local Indian supplier, with Victor and ESAB available in India. We can see from the Table 2 that all the three had given different nos. to the Tip/Nozzle. Similarly the Oxygen and Acetylene cylinder pressure is same for Victor and Local Indian Manufacturers

for the first few tip sizes. These numbers of welding tips/nozzles are generally used in LP gas welding. For example Victor starts the Welding nozzle/Tip from 000(for welding 0.8mm sheet) to 2(for welding 3.2mm) using a uniform oxyacetylene pressure. It shows that in operational and parameter data are also different provided by the manufacturer.

Problems in Standardization of tip/nozzle –

AWS in 2000 issued the ANSI-AWS C4.5M uniform designation system for Oxy-Fuel nozzles. The standard gives detail parameter for uniform designation system for oxy fuel nozzle. The standard follows only International system of units (SI). The standard clearly gives detail description on marking and safety and health requirement.

In marking requirement there are three main features to be marked on the welding nozzle/tip and they are fuel gas designation, welding capacity and marking configurations. In fuel gas designation the manufacturer must stamp the abbreviation of fuel gas used [Table 3]. The welding capacity of nozzle or the thickness of material that can be weld must be marked in millimeter. The marking configurations include the manufacturer identification or company name model or part number of the nozzle. Example VT202A6mm. Here VT is manufacturer name or mark 202 is model of nozzle A is acetylene and 6mm thickness of material.

The clause further states that under the safety and health requirements the manufacturer must provide the detailed instructions for the proper setting gas nozzles. The information must be provided pressure setting is given in kilopascals (Pa) and the flow rates in Liters per minute (LPM) for oxygen and fuel gases used [4].

However because the standard is not mandatory, many manufacturers are not in compliance because of the additional of changing or adding stamps. The stamping cost will increase the production cost and hence product cost. So very less manufacturers maintain the standards. The second factor affecting compliance is that the standard requires the use of metric measurements for thickness and flow [5].

Table: 1 Welding tip Selection Chart

Welding Tip Size Conversion Chart									
Wire Drill Size	Decimal Inch	Metric Eqiv.(mm)	Smiths AW1A	Little Torch	Harris	Victor	Meco Midget	Messer	GCE Rhona
97	0.0059	0.150		2					
85	0.0110	0.279		3					
80	0.0135	0.343					#00		
76	0.0200	0.508	AW200	4			#0	#00	#00
75	0.0220	0.559			#0	#000			
74	0.0225	0.572	AW20					#0	#0
73	0.0240	0.610					0.5		
71	0.0260	0.660	AW201		1			1	1
70	0.0280	0.711				#00	1		
69	0.0292	0.742	AW202	5				2	2
67	0.0320	0.813	AW203				1.5		
65	0.0350	0.889			2	#0	2		
63	0.0370	0.940	AW204	6			2.5		2E
60	0.0400	1.016				1			
58	0.0420	1.067			3		3		
57	0.0430	1.092	AW205						
56	0.0465	1.181	AW206	7		2	4	3	3
55	0.0520	1.321			4				
54	0.0550	1.397	AW207				4.5	3,5	3E
53	0.0595	1.511			5	3			
52	0.0635	1.613	AW208				5	4	4
51	0.0670	1.702			6				
49	0.0730	1.854	AW209			4	5.5		4E
48	0.0760	1.930			7				
47	0.0780	1.981					6		
45	0.0820	2.083			8				
44	0.0860	2.184	AW210				6.5	5	5
43	0.0890	2.261			9	5			
42	0.0930	2.362					7		
40	0.0980	2.489			10				
36	0.1060	2.692				6			
35	0.1100	2.794			13				

Operational and Performance Data for ESAB Welding Tip/Nozzles							
SN	Material Thickness		Tip Size	Oxygen Pressure		Acetylene Pressure	
	mm	Inches		Bar	PSI	Bar	PSI
1	1.2	3/64"	2	1.5	20	0.14	2
2	2	5/64"	3	1.5	20	0.14	2
3	3	1/8"	6	2.5	35	0.21	3
4	5	3/16"	13	2.5	35	0.21	3
5	8	5/16"	20	3	45	0.28	4
6	10	3/8"	30	3	45	0.28	4
7	12	13/32"	35	3.5	50	0.42	6
8	14	9/16"	45	3.5	50	0.42	6
9	16	5/8"	55	4	60	0.56	8
10	20	13/16"	70	4	60	0.7	10
11	25	1"	90	4.5	65	0.7	10

Operational and Performance Data for Victor Welding Tip/ Nozzles						
SN	Metal Thickness	Tip Size	Drill Size	Oxygen	Acetylene	Acetylene
	Inch(mm)			(PSIG)	(PSIG)	(SCFH)
1	1/32"(0.8)	000	75(0.022)	3/5	3/5	1/2
2	3/64"(1.2)	00	70(0.028)	3/5	3/5	1.5/3
3	1/8"(3.2)	0	65(0.035)	3/5	3/5	2/4
4	3/32"(4.8)	1	60(0.040)	3/5	3/5	3/6
5	1/8"(3.2)	2	56(0.046)	3/5	3/5	5/10
6	3/16"(4.8)	3	53(0.060)	4/7	3/6	8/18
7	1/4"(6.4)	4	49(0.073)	5/10	4/7	10/25
8	1/2"(12.7)	5	43(0.089)	6/12	5/8	15/35
9	3/4"(19.0)	6	36(0.016)	7/14	6/9	25/45
10	1 1/4"(32.0)	7	30(0.128)	8/16	8/10	30/60
11	2"(51.0)	8	29(0.136)	10/19	9/12	35/75
12	3"(76.2)	10	27(0.144)	12/24	12/15	50/100

Operational and Performance Data by Local Indian Suppliers					
SN	Thickness(mm)	Tip Size	Oxygen Pressure (kg/cm2)	Acetylene Pressure (kg/cm2)	Consumption of each gas (m3/hr)
1	0.6	0	0.14	0.14	0.03
2	0.91	1	0.14	0.14	0.03
3	1.2	2	0.14	0.14	0.06
4	2.1	3	0.14	0.14	0.09
5	2.6	5	0.14	0.14	0.14
6	3.2	7	0.28	0.28	0.2
7	3.9	10	0.28	0.28	0.3
8	4.8	13	0.28	0.28	0.4
9	6.4	18	0.42	0.42	0.5
10	8	25	0.42	0.42	0.7

Table 2 Comparison of Welding Tip/Nozzle with the Operational and Performance Data

Designation and Abbreviations of the Gases		
SN	Designation	Abbreviations
1	Acetylene	A
2	Natural Gas/Methane	M
3	Propane, Propane-Based fuels	P
4	Hydrogen	H
5	MPS (Methylacetylene-Propadiene Mixtures)	Y
6	Propylene	L

Table 3 Designation and Abbreviations of the Gases

Conclusion –

The non uniformity in sizing and standardization of welding tip and nozzle is creating confusion. The Low pressure gas welding is widely used in Indian cities. The new learners take the knowledge as told by them while practicing. So the selection is done on the basis of use or simply information provided by manufacturer. The welder must carefully select the welding tip and make sure it provides sufficient gas to run without overheating and backfire. The government agenesis must provide the standards which can be implemented by the manufacturer with universally accepted norms and specification with very less cost. These specifications must be stamped on the welding tip nozzle to eliminate the confusion of tip size numbers.

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