

## APPENDIX-A-1

## Tables

### Chemical compositions of IS 2062

IS 2062 structural steel chemical composition							
% C max	% Mn max	% S Max	% P max	%Si Max	% of Cu	Fe	Carbon Equivalent
0.22	1.5	0.049	0.05	0.37	-----	Balance	0.42

A-1. Chemical composition of IS 2062 structural steel

### Chemical compositions of AISI 304

AISI 304 chemical composition							
% of C	% of Cr	% of Ni	% of Mn	% of Si	% of P	% of S	Fe
0.06	18.68	8.54	1.9	0.41	0.03	0.005	Balance

A-2. Chemical composition of AISI 304H

### Chemical compositions of Filler wires ER70S-6M (for IS 2062 steel)

% C	% Mn	% Si	% S	% P	%Cu
0.12	1.75	0.90	0.03	0.03	0.50

A-3. Chemical composition of Metal-cored wire ER70S-6M

(Filler wire for IS 2062 steel)

### Chemical compositions of Filler wires for AISI 304

AWS Classification	% of C	% of Mn	% of Si	% of S	% of P	% of Cr	% of Ni	% of Mo	% of Cu
ER 308	0.08 max.	1.0-2.5	0.30-0.65	0.03 max	0.03 max	19.5-22	9-11	0.75 max	0.75 max

A-4. Chemical composition of ER308 grade filler wire (filler wire for AISI 304)

Table A-5 Summary of Gas Metal Arc (GMA) Welding parameters for IS 2062 steel

S.No	Parameters	No. of passes	I <sup>st</sup> condition	II <sup>nd</sup> condition	III <sup>rd</sup> condition	IV <sup>th</sup> condition
1	WFS (m/min)	I <sup>st</sup> pass	7.62	8.89	10.16	11.43
		II <sup>nd</sup> pass	7.62	8.89	10.16	11.43
2	Voltage	I <sup>st</sup> pass	25	26	27	28
		II <sup>nd</sup> pass	25	26	27	28
3	Travel Speed (m/min)	I <sup>st</sup> pass	1.599	1.788	1.912	2.245
		II <sup>nd</sup> pass	1.654	1.791	1.968	2.225
4	SGFR (l/m)	I <sup>st</sup> pass	10	15	20	25
		II <sup>nd</sup> pass	10	15	20	25
5	Polarity		DCEP	DCEP	DCEP	DCEP
6	Groove		Single-V	Single-V	Single-V	Single-V
7	Heat Input (kJ/mm)		3.22	3.58	3.88	4.47

Table A-6 Summary of Gas Metal Arc (GMA) welding parameters for AISI 304 steel

S.No	Parameters	No. of passes	I <sup>st</sup> condition	II <sup>nd</sup> condition	III <sup>rd</sup> condition	IV <sup>th</sup> condition
1	WFS (m/min)	I <sup>st</sup> pass	6.35	7.62	8.89	10.16
		II <sup>nd</sup> pass	6.35	7.62	8.89	10.16
2	Voltage	I <sup>st</sup> pass	20	21	22	23
		II <sup>nd</sup> pass	20	21	22	23
3	Travel Speed (m/min)	I <sup>st</sup> pass	1.080	1.050	1.29	1.511
		II <sup>nd</sup> pass	0.810	1.120	1.49	1.499
4	SGFR (l/m)		10	15	20	25
			10	15	20	25
5	Polarity		DCEP	DCEP	DCEP	DCEP
6	Groove		Single-V	Single-V	Single-V	Single-V
7	Heat Input (kJ/mm)		1.89	2.17	2.78	3.01

A-7 Different Mechanical properties of IS 2062 steel welded joint at heat input 3.22 kg/mm

Wire feed speed(m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
7.62	5	239	426	184	171.04	8
7.62	10	240	430	196	176	8.6

7.62	15	242	427	182	186.51	7.6
7.62	20	245	417	197	180	7
8.89	5	240	450	204	178	10
8.89	10	241	390	200	178	10
8.89	15	243	425	202	180	12.6
8.89	20	246	365	218	181	9
10.16	5	242	430	186	172	8.5
10.16	10	243	427	188	171	7.8
10.16	15	244	410	190	171	9
10.16	20	245	409	195	168	9.5
11.43	5	239	390	192	191.31	10.2
11.43	10	240	365	198	187	10
11.43	15	240	360	190	186	11
11.43	20	241	325	208	183	11.6

A-8 Different Mechanical properties of IS 2062 steel welded joint at heat input 3.58 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
7.62	5	230	484.55	168	185.68	10.5
7.62	10	229	497.45	160	189	11.9
7.62	15	237	501	166	186.51	10
7.62	20	238	490	168	185	12.3
8.89	5	233	480	170	189	9
8.89	10	235	505	166	185	9.4
8.89	15	239	501	174	180	8.1
8.89	20	239	490	176	186	10
10.16	5	239	450	162	180	9
10.16	10	239	463	156	188	8
10.16	15	243	452	160	182	8.5
10.16	20	241	448	158	184	11
11.43	5	249	476.6	182	181	11
11.43	10	247	475.5	178	182.35	11
11.43	15	246	466.7	180	181	12
11.43	20	244	447	172	178	13

A-9 Different Mechanical properties of IS 2062 steel welded joint at heat input 3.88 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
7.62	5	240	499.21	188	187	16
7.62	10	238	479.5	200	184	14
7.62	15	239	468.34	177	183	15
7.62	20	241	503	206	174	18

8.89	5	243	459	199	202	18
8.89	10	240	440	208	206	16
8.89	15	241	401	196	186	17
8.89	20	243	463	215	185	20
10.16	5	246	482	192	181	18
10.16	10	244	489	190	181	17
10.16	15	246	487.7	190	180	17
10.16	20	243	502	210	179	19
11.43	5	246	435	224	178	16
11.43	10	244	438	212	178	15.4
11.43	15	246	414	220	170	16
11.43	20	247	428	232	172	17

A-10 Different Mechanical properties of IS 2062 steel welded joint at heat input 4.47 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
7.62	5	243	510	208	164.6	16.3
7.62	10	244	530.65	192	170	15.3
7.62	15	245	532.6	182	165.88	12.6
7.62	20	244	490	194	175	17.3
8.89	5	245	498	210	177	16
8.89	10	246	524	192	181	16.5
8.89	15	245	483	192	175	12
8.89	20	247	497	215	168	18
10.16	5	244	515	220	171	18
10.16	10	245	510	198	175	13
10.16	15	244	496.1	219	180	15
10.16	20	244	478	199	185	11
11.43	5	245	505	211	180	15
11.43	10	247	512	198	177	16
11.43	15	246	495	224	178	14
11.43	20	247	490	195	183	12

A-11 Different Mechanical properties of AISI 304 steel welded joint at heat input 1.89 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
6.35	5	330	470	182	178	15
6.35	10	329	451	210	191	17.2
6.35	15	330	450	188	200	15
6.35	20	328	475	180	182	12
7.62	5	329	480	190	178	21

7.62	10	328	460	190	169	23
7.62	15	325	482	196	188	20
7.62	20	326	480	200	170	23
8.89	5	331	491	268	175	17
8.89	10	329	470	260	174	19
8.89	15	332	486	260	188	20
8.89	20	330	487	270	171	23.7
10.16	5	328	460	258	171	22
10.16	10	330	428	254	170	24
10.16	15	329	459	257	166	28
10.16	20	327	449	258	177	27

A-12 Different Mechanical properties of AISI 304 steel welded joint at heat input 2.17 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
6.35	5	323	503	210	170	15
6.35	10	320	502	215	188	21
6.35	15	321	483	219	173	18
6.35	20	322	464	190	168	16
7.62	5	324	524	170	171	12
7.62	10	321	510	198	181	20.6
7.62	15	322	506	209	180	17
7.62	20	323	488	178	175	12
8.89	5	320	514	220	174	18
8.89	10	319	514	234	183	25
8.89	15	317	497	266	179	24
8.89	20	318	505	260	175	17
10.16	5	324	480	205	172	16
10.16	10	325	501	190	180	20
10.16	15	320	486	210	179	20
10.16	20	322	490	222	172	16

A-13 Different Mechanical properties of AISI 304 steel welded joint at heat input 2.78 kJ/mm

Wire feed speed (m/min)	Gas flow rate (l/m)	YS MPa	UTS MPa	Toughness joule	Micro Hardness (VHN)	% elongation
6.35	5	318	480	200	202	10.5
6.35	10	316	502	198	200	11.5
6.35	15	317	454	205	184	11
6.35	20	319	522	190	177	15
7.62	5	319	501	180	206	10
7.62	10	320	453	189	199	9.5
7.62	15	321	491	191	175	15

7.62	20	321	596	162	185	17
8.89	5	322	539	222	202	15
8.89	10	323	499	262	205	13
8.89	15	319	546	240	177	15
8.89	20	323	590	232	190	18
10.16	5	324	619	210	195	18
10.16	10	320	528	220	199	14
10.16	15	321	600	216	183	17
10.16	20	322	620	225	175	20

A-14 Different Mechanical properties of AISI 304 steel welded joint at heat input 3.01 kJ/mm

<b>Wire feed speed (m/min)</b>	<b>Gas flow rate (l/m)</b>	<b>YS MPa</b>	<b>UTS MPa</b>	<b>Toughness Joule</b>	<b>Micro Hardness (VHN)</b>	<b>% elongation</b>
6.35	5	325	482	188	186	10
6.35	10	323	489	176	182	11
6.35	15	323	559	174	180	12
6.35	20	324	615	184	190	10
7.62	5	323	636	180	188	12
7.62	10	318	560	160	176	15
7.62	15	320	647	146	202	18
7.62	20	321	670	200	210	16.2
8.89	5	319	507	208	184	9
8.89	10	316	607	212	179	14
8.89	15	317	569	196	201	14
8.89	20	318	605	200	190	10
10.16	5	320	596	195	201	15
10.16	10	319	516	196	188	11
10.16	15	318	518	188	203	14
10.16	20	319	590	196	202	15