MAG wire

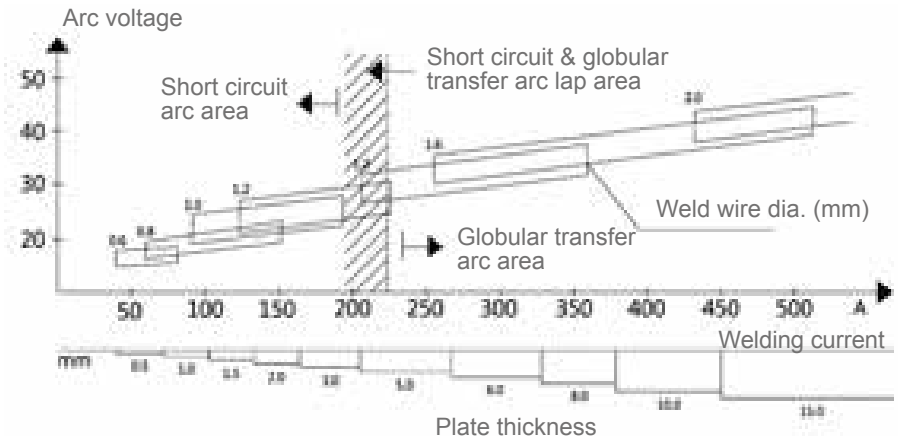
Welding Consumables Selection

Product name	Shielding gas	Property description	Specification	
			AWS	JIS
S-4	CO_2 or mixing gas (note)	Better deoxidation effect than ER70S-3, no charpy impact requirement.	ER 70S-4	YGW 12
S-6	CO_2 or mixing gas (note)	Available for single and multi-passes, good anti-rust capability, and good for high current welding.	ER 70S-6	YGW 12
S-G	CO_2 or mixing gas (note)	Available for single and multi-passes, requirements are those agreed to by the purchaser and the supplier.	ER 70S-G	YGW 11
GW11	CO_2	Contain Ti (or Zr) deoxidation element, suitable for mild and 490MPa high strength steel high current welding.	—	YGW 11
GW12	CO_2	Suitable for mild and 490MPa high strength steel, low current, thin plate and full position welding.	—	YGW 12
GW15	80%Ar+20%CO_2	Contain Ti (or Zr) deoxidation element, suitable for mild and 490MPa high strength steel high current welding.	—	YGW 15
GW16	80%Ar+20%CO_2	Suitable for mild and 490MPa high strength steel, low current, thin plate and full position welding.	—	YGW 16
GW18	CO_2	Contain Mo and Ti (or Zr) deoxidation element, suitable for high current high heat input welding, better mechanical properties than YGW11.	ER 80S-G	YGW 18
GW19	80%Ar+20%CO_2	Contain Mo and Ti (or Zr) deoxidation element, suitable for high current high heat input welding, better mechanical properties than YGW15.	ER 90S-G	YGW 19

Note : when using Ar+CO_2 mixing gas, Si and Mn content of weld metal will be increased by Ar increasing.

Welding Notes

1. The following shielding gases are commonly applied on GMAW : CO_2, Ar + CO_2 & Ar + O_2 , etc.
2. Shielding gas flow rate: 20 ~ 25 L/min.
3. Proper shelter is necessary on windy area to prevent air (O_2 & N_2) trapping into arc and melting pool.
4. Ventilation is absolutely necessary when welding inside a limited or restricted partition.
5. Keep welding wire in dry condition even there is an anti rust cooper coated film on wire surface.
6. Shielding gas regulator, wire feeder, welding equipment, and other related accessories shall be function checked carefully before welding to prevent abnormal defects occurred.
7. Gas mixing rate will affect welding results (Weld metal properties such as tensile strength and toughness may be changed from one mixing rate of shielding gas to another). The mixing rate shall be specified for keeping a constant supply during welding.
8. Vertical and overhead positions are not recommended on main structural parts.
9. The following diagram is showing how to select arc transfer mode within the suitable corresponding welding current range.



Note: the welding current and voltage will affect the arc transfer mode.

10. The referenced welding parameters are as follows :

Wire size (mm)	Welding Current (A)	Welding Voltage (V)
0.6	40 – 80	12 – 18
0.8	60 – 160	15 – 23
0.9	60 – 200	19 – 27
1.0	80 – 230	19 – 29
1.2	120 – 350	20 – 34
1.4	240 – 380	26 – 38
1.6	260 – 450	28 – 40

11. The difference between MIG and MAG
    MAG: A variation of GMAW, shielding gas can be CO_2 , Ar +CO_2 or Ar+O_2
    MIG: A variation of GMAW, shielding gas is 100% inert gas such as Argon or helium or Ar + He
12. The polarity illustration:
    DCEP (DC+): Electrode positive or DC reverse polarity (DCRP).
    DCEN (DC–): Electrode negative or DC straight polarity (DCSP).

S-G

AWS A5.18M ER48S-G / A5.18 ER70S-G
JIS Z 3312 YGW11

Product Features:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel.
- Ti element contained in wire for improving oxidation resistance, less spatter loss.
- High welding performance, suitable for high current welding.
- High welding speed, deep penetration and high welding efficiency.

Applications:

- Suitable for welding of mild and 490 N/mm^2 high tensile strength steel structures on vehicles, machinery, bridges, pressure vessels and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S	Ti+Zr
0.07	0.80	1.54	0.025	0.013	0.22

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-20°C) J
516	572	29.6	81.5

Size (mm) & recommended welding parameters (A) DC+

Diameter	1.2	1.4	1.6
Flat position	120~350	240~380	260~450
Horizontal fillet position	120~350	240~380	260~450
Shielding Gas	CO_2		

◎ Note: Refer to page A21 welding note.

S-6

AWS A5.18M ER48S-6 / A5.18 ER70S-6
JIS Z 3312 YGW12

Product Features:

- Suitable for welding of mild and 490 N/mm^2 high tensile strength steel.
- Suitable for thin plate and all position welding.
- Higher Si and Mn elements contained in wire for improving oxidation resistance capability.

Applications:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel structures on vehicles, general electrical, light steel, pipe, steel constructions, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S
0.08	0.90	1.50	0.016	0.006

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-30°C) J
485	570	28	62

Size (mm) & recommended welding parameters (A) DC+

Diameter	0.8/0.9	1.0	1.2	1.6
Flat position	60~200	80~230	120~350	260~400
Vertical position	60~100	80~180	120~150	—
Shielding Gas	CO_2			

◎ Note: 1. Refer to page A21 welding note.
2. Not recommend for vertical position (upward and downward) on structure parts.

S-4 / GW16

AWS A5.18M ER48S-4 / A5.18 ER70S-4
JIS Z 3312 YGW16

Product Features:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel.
- Suitable for thin plate and all positions.
- High welding performance.
- Available for low to moderate current range, good arc stability, less spatter loss and good bead appearance.

Applications:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel structures on vehicles, general electrical, light steel, pipe, steel constructions, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S
0.06	0.81	1.49	0.021	0.023

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (0°C) J
473	567	27	84

Size (mm) & recommended welding parameters (A) DC+

Diameter	0.9	1.0	1.2
Flat position	60~200	80~230	120~350
Vertical position	60~100	80~180	120~150
Shielding Gas	CO_2		

◎ Note: 1. Refer to page A21 welding note.
2. Not recommend for vertical position (upward and downward) on structure parts.

GW11

AWS A5.18M ER48S-G / A5.18 ER70S-G
JIS Z 3312 YGW11

Product Features:

- Suitable for welding of mild and 490 N/mm^2 high tensile strength steel.
- Ti element contained in wire for improving oxidation resistance capability ,less spatter loss.
- High welding performance, suitable for high current welding.
- High welding speed, deep penetration and high welding efficiency.

Applications:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel structures on vehicles, general electrical, light steel, pipe, steel constructions, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S	Ti+Zr
0.07	0.89	1.60	0.020	0.025	0.2

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-20°C) J
530	592	29.2	85.2

Size (mm) & recommended welding parameters (A) DC+

Diameter	1.2	1.4	1.6
Flat position	120~350	240-380	260~450
Horizontal fillet position	120~350	240-380	260~450
Shielding Gas	CO_2		

◎ Note: Refer to page A21 welding note.

GW12

AWS A5.18M ER48S-6 / A5.18 ER70S-6
JIS Z 3312 YGW12

Product Features:

- Suitable for welding of mild and 490 N/mm^2 high tensile strength steel.
- Suitable for thin plate and all positions welding.
- Higher Si and Mn elements contained in wire for improving oxidation resistance capability.

Applications:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel structures on vehicles, general electrical, light steel, pipe, steel structure, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S
0.07	0.86	1.51	0.015	0.018

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-30°C) J
465	570	28	62

Size (mm) & recommended welding parameters (A) DC+

Diameter	0.8/0.9	1.0	1.2	1.6
Flat position	60~200	80~230	120~350	260~400
Vertical position	60~100	80~180	120~150	—
Shielding Gas	CO_2			

◎ Note: 1. Refer to page A21 welding note.
2. Not recommend for vertical position (upward and downward) on structure parts.

GW15

JIS Z 3312 YGW15

Product Features:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel.
- Available for wider welding current range.
- Good arc stability, low spatter loss and good bead appearance even in very low welding current.

Applications:

- Suitable for welding of mild and 490 N/mm^2 grade high tensile strength steel structures on vehicles, general electrical, light steel, pipe, steel structure, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	P	S
0.06	0.59	1.45	0.004	0.022

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-20°C) J
475	545	30.4	145

Size (mm) & recommended welding parameters (A) DC+

Diameter	0.9	1.0	1.2
Flat position	60~200	80~230	120~350
Vertical position	60~100	80~180	120~150
Shielding Gas	mixed gas		

◎ Note: 1. Typical all weld metal mechanical properties obtained from 80%Ar+20%CO_2 shielding gas welding test.
2. Refer to page A21 welding note.
3. Not recommend for vertical position(upward and downward) on structure parts.

GW18

AWS A5.28M ER55S-G / A5.28 ER80S-G
JIS Z 3312 YGW18

Product Features:

- Suitable for welding of 550 N/mm^2 grade high tensile strength steel.
- Good for high heat input welding.
- Good mechanical properties.
- Ti element contained for improving oxidation resistance, less spatter loss.

Applications:

- Suitable for welding of 550 N/mm^2 grade high tensile strength steel structures on vehicles, light steel, pipe, steel structure, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	Mo	Ti
0.06	0.82	1.88	0.16	0.20

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (0°C) J
628	676	26.2	168

Size (mm) & recommended welding parameters (A) DC+

Diameter	1.2	1.4	1.6
Flat position	120~350	240-380	260~450
Horizontal fillet position	120~350	240-380	260~450
Shielding Gas	CO_2		

◎ Note: Refer to page A21 welding note.

GW19

AWS A5.28M ER62S-G / A5.28 ER90S-G
JIS Z 3312 G62A0UM19

Product Features:

- Suitable for welding of 620 N/mm^2 grade high tensile strength steel.
- Good for higher heat input welding.
- Good mechanical properties.
- Ti element contained for improving oxidation resistance, less spatter loss.

Applications:

- Suitable for welding of 620 N/mm^2 grade high tensile strength steel structures on vehicles, light steel, pipe, steel structure, bridge and shipbuilding.

Typical chemical composition of wire (%)

C	Si	Mn	Mo	Ti
0.09	0.6	1.46	0.12	a little

Typical mechanical properties of all weld metal

Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Impact value (-30°C) J
666	728	25.2	118

Size (mm) & recommended welding parameters (A) DC+

Diameter	1.2	1.4	1.6
Flat position	120~350	240~380	260~450
Horizontal fillet position	120~350	240~380	260~450
Shielding Gas	mixed gas		

◎ Note: 1. Typical all weld metal mechanical properties obtained from 80%Ar+20%CO_2 shielding gas welding test.
2..Refer to page A21 welding note.

The classification level of GW18 & GW19

Some users may feel strange and be interesting in products of GW18 and GW19 (JIS 3312 YGW18 & YGW19). Users may find the classification level is different between AWS and JIS of these two products. According to values of mechanical properties, these two products can be applied to higher strength than traditional high strength steels on AWS classification base.

These two classes of wires were developed in Japan based on the Hanshin and Earthquake experience. To improve the strength of box column or beam joints (building structure) can improve structure member earthquake resistance level. The mechanical properties are mainly affected by weld metal and the weld metal will be mainly affected by welding parameters such as heat input, preheat and interpass temperature etc. Most of steel structure welding usually applies high heat input such as increasing welding current and keeping high inter pass temperature (less waiting time for cooling) to improve efficiency; however, this method will induce coarsen grain structure in weld metal and cause detrimental mechanical properties (decreasing strength and toughness in weld metal). Heat input and inter pass temperature are absolute essential control parameters for getting good results to satisfy related code requirement.

After a long discussion and research among Japanese Architecture Society and construction companies, new welding wires (filler metals) were developed and new construction standard was issued in which the weld metal can stand not only high heat input and high inter pass temperature but also meets required mechanical properties. JIS made a revision to incorporate these welding materials consequently. GW18 and GW19 were produced in accordance with JIS revised classifications and are currently national standard welding filler metals. These wires are designed so that the weld metal can meet 490MPa strength requirement with high heat input and high interpass temperature (350˚C max.). These wires also can weld higher than traditional high strength grade steels from decreasing heat input and lowering interpass temperature in order to get higher strength weld metals.

Applicable Steel Grade	Wire Type	Welding Condition	
		Heat Input KJ/cm	Interpass Temperature°C
Grade 400MPa	YGW11, 15, 18, 19	15~40	≦350
		15~30	≦150
Grade 490MPa	YGW11, 15	15~30	≦250
	YGW18, 19	15~40	≦350
Grade 520MPa	YGW18, 19	15~30	≦250

Single Beveled Joint Testing (Sample from GW18)					
Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Toughness (Charpy Impact Values) (0°C) J	Heat Input KJ / cm	Interpass Temperature
509	621	26.2	122	40	350°C

From reviewing the above testing data, it is obvious to see how the heat input and interpass temperature impact the welding result (weld metal mechanical properties). The above testing results also tells us to get an ideal weld metal strength is not only on selecting the right filler metal but also how to control the welding parameters (to follow a qualified welding procedure shall be absolutely necessary).