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Flux-Cored Wire for Gas Shield Arc Welding
"DWA-55ESR"



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DWA-55ESR is a rutile (TiO₂) based flux-cored wire for out-of-position welding work of low temperature service steel, mild steel and 70ksi class high tensile steel (A36) along with 75-80%Ar – balanced CO₂ gas shielding..

- 1) **Excellent notch toughness** properties can be achieved in as welded and stress relief condition to low temperature service steel used down to -40° F.
- 2) **All position welding** can be achieved with **good bead appearance, negligible spatter and excellent slag removability**.
- 3) DWA-55ESR provides **less fume** and **less spattering** welding in any welding position just like E71T-1 grade flux cored wire
- 4) **Non-baked** and shiny wire surface covered with special lubricant creates smooth wire feedability and extended liner life.



1. Wire specification

Table1 Specifications of wire

Typical applications	-Mild steels and High tensile strength steels -Multi-pass and single-pass applications
Polarity of power supply	DC-EP
Applicable classification	AWS A5.20 / ASME SFA 5.20 E71T-1, E71T-12 MJ H8
Applicable size	0.045in., 1/16in.
Applicable unit quantity	44lbs Spool
Approval by the shipping registers	AB 4Y400SA (H5)

2. Properties of undiluted deposited metal

Tensile properties, toughness property and its chemistry of undiluted deposited metal with 75%Ar-25%CO₂ are shown in Table2 and Table3 respectively, which were obtained by testing in accordance with AWS specification A5.20. Welding condition per diameter is described under the Table3.

And also, additional test results are shown in Fig.1 and 2 to clarify how cooling rate, which is controlled by changing heat input and interpass temperature, affects weldment done with DWA-55ESR. More details of testing condition are listed on Table.4 regarding controlling cooling rate.

Table2 Typical mechanical properties of undiluted deposited metal ^{*1}

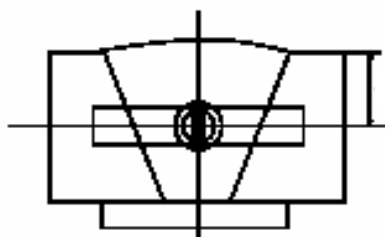
PWHT	Diameter in.	0.2%P.S. ksi (N/mm ²)	T.S ksi (N/mm ²)	EI %	Impact value ft-lbs (J)	
					-40°F	0 °F
As weld	0.045	75.9 (524)	85.4 (590)	29	100<97,103,101> (136<131,139,137>)	117<118,111,120> (158<160,150,163>)
	1/16	73.7 (509)	85.3 (589)	28	85<72,96,87> (115<97,130,118>)	112<113,114,108> (152<153,155,147>)
	AWS specification	≥58 (≥390)	70 – 90 (490-620)	≥22	≥20 (≥27)	---
1150°F × 3Hrs	0.045	68.3 (472)	81.2 (561)	31	69<55,82,69> (93<75,111,94>)	86<94,97,69> (117<127,131,93>)
	1/16	64.9 (448)	79.7 (550)	34	69<84,54,74> (96<114,73,101>)	99<86,103,108> (134<116,139,147>)
	AWS specification	---	---	---	---	---

Table3 Typical Chemical composition of deposited metal (mass%)

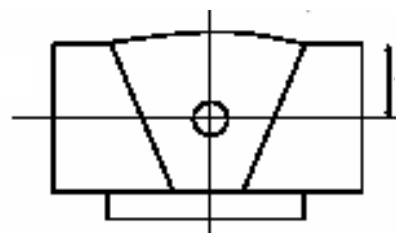
PWHT	Diameter inch	C	Mn	Si	P	S	Ni
As weld	0.045	0.06	1.50	0.57	0.009	0.006	0.45
	1/16	0.06	1.41	0.49	0.010	0.008	0.42
	AWS specification	≤0.12	≤1.60	≤0.90	≤0.030	≤0.030	≤0.50
1150°F × 3Hrs	0.045	0.06	1.49	0.57	0.009	0.006	0.45
	1/16	0.05	1.40	0.49	0.010	0.008	0.44
	AWS specification	---	---	---	---	---	---

0.045" : 280A-30V with pass sequence of 6 layers-12passes (2passes/layer) ...HIP=38.1kJ/in.

1/16" : 340A-32V with pass sequence of 6 layers-12passes (2passes/layer) ...HIP=43.9kJ/in.



Location of tensile test and toughness test



Location of chemical analysis

Table4 How to control cooling rate

Dia.	Pass sequence (passes/layers)	PWHT	Interpass (°F)	Heat Input (kJ/in.)	Cooling rate (°F/sec.)	Remarks	
0.045"	12/6	As welded	300	38.1	30.4	Same as in margin of Table3	
		SR		38.1	30.4		
	8/6	As welded		52.8	15.8		
		SR		52.8	15.8		
	6/5	As welded		480	67.6	9.7	
		SR			67.6	9.7	
		As welded	65.5	4.3			
		SR	66.8	4.1			
1/16"	12/6	As welded	300	45.0	21.8	Same as in margin of Table	
		SR		42.9	23.9		
	8/6	As welded		70.3	8.8		
		SR		68.6	9.4		
	6/5	As welded	480	88.9	5.6		
		SR		87.1	5.8		
		As welded		88.9	2.3		
		SR		90.2	2.2		

* Cooling rate is calculated at 1000°F by Rosenthal formula utilizing interpass temp and heat input.

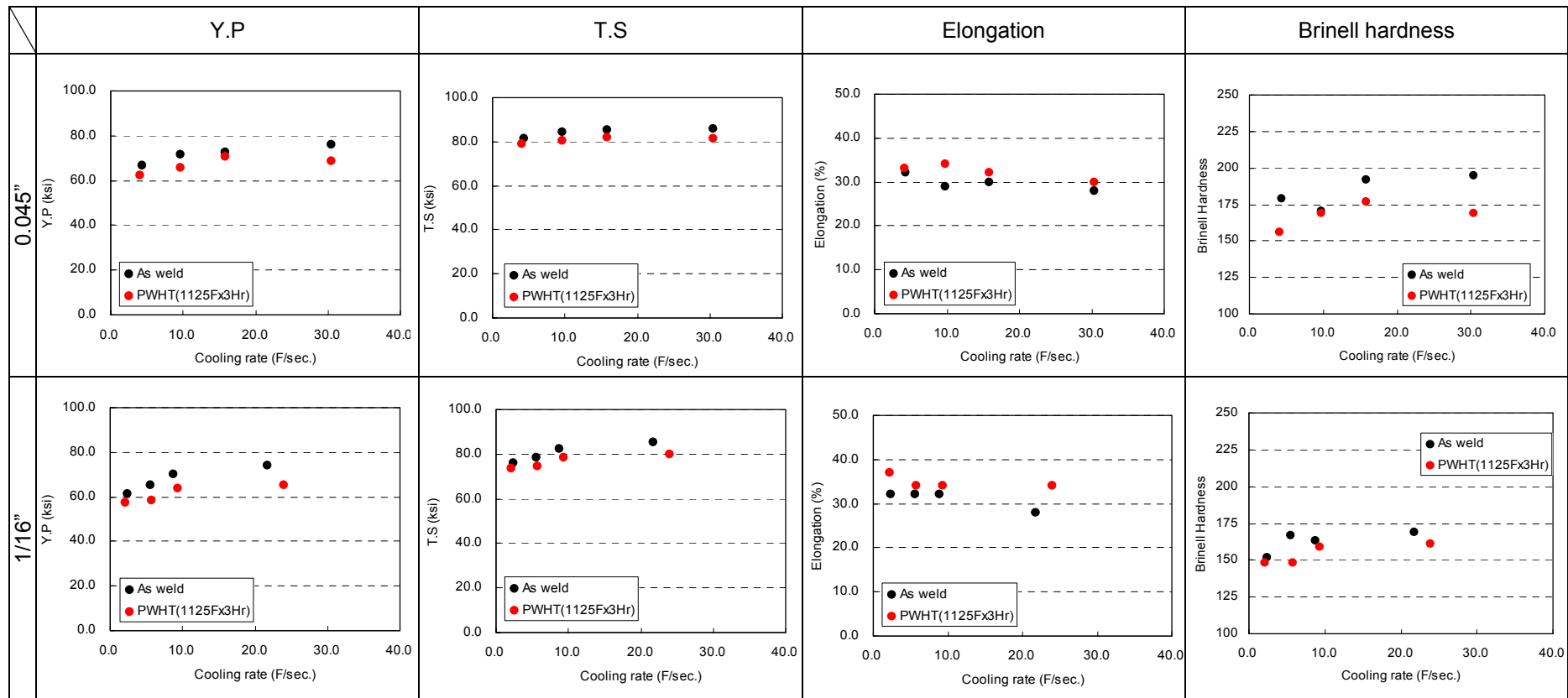
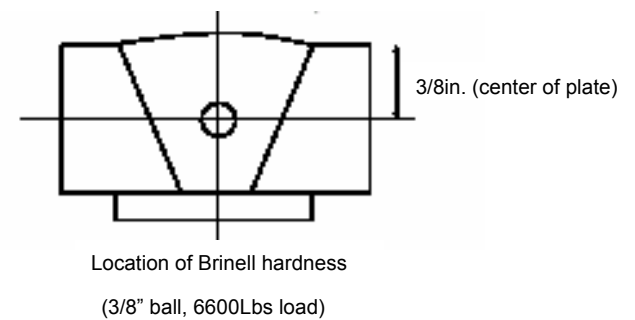


Fig.1 Results of tensile and hardness test *2



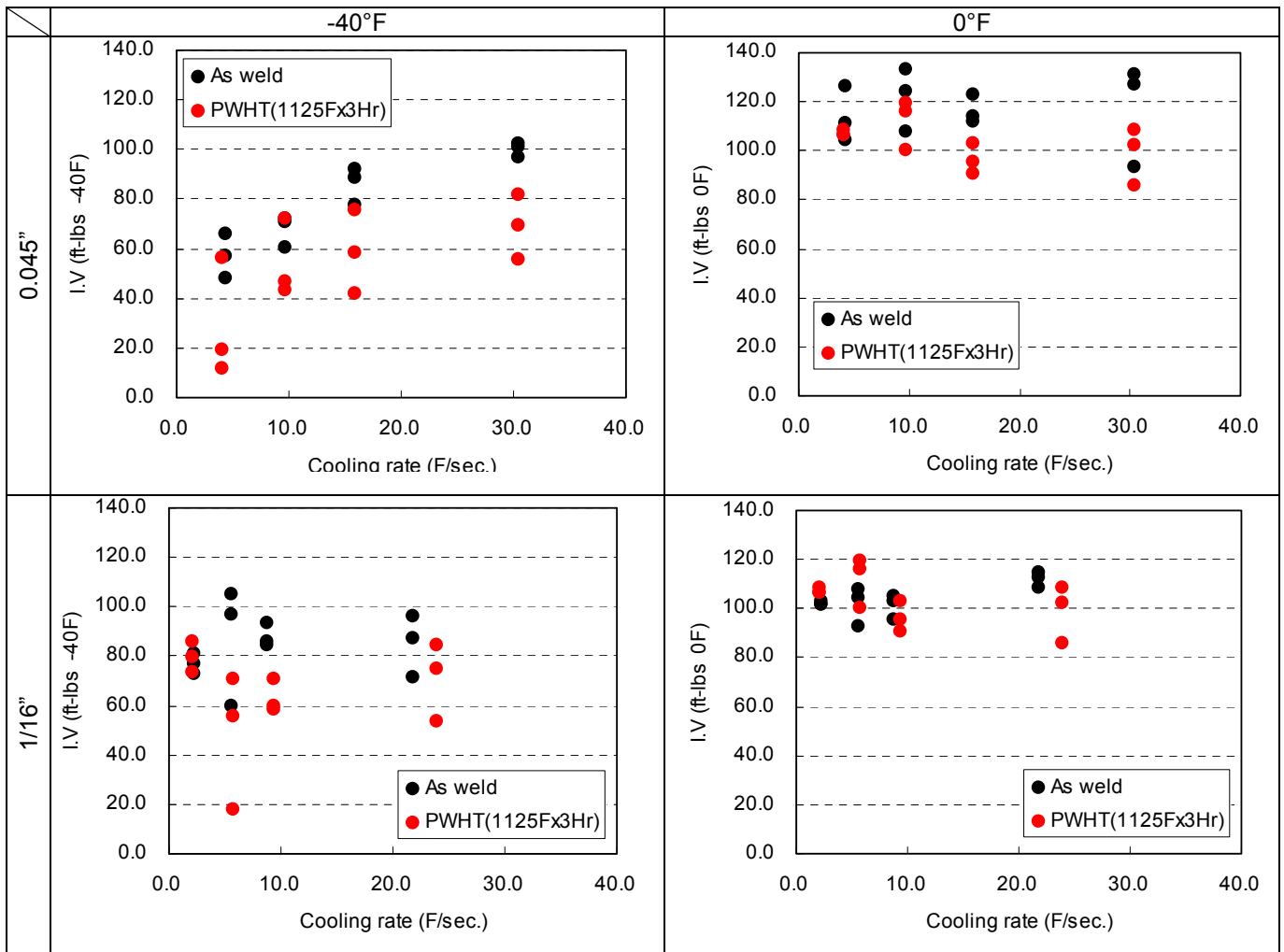


Fig.2 Results of t toughness test *2

3. Properties of butt joint (0.045in.)

The butt joint test was performed according to the welding conditions shown in Table5 and 6. The test results are shown in Table7 and Table8 individually.

Table5 Welding condition and pass sequence

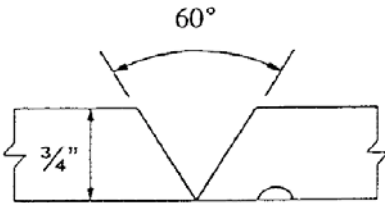
Welding position	Flat (1G), Horizontal (2G), Vertical upward (3G)	(Joint design) 
Welding wire	DWA-55ESR 0.045in.	
Welding current	200-280A	
Shielding gas	75%Ar-25%CO ₂ 53CFH(25L/min)	
Current and polarity	DC-EP	
Preheat temp.	Room temp.	
Interpass temp.	300 ± 20°F (150 ± 10°C)	
Test plate	JIS G3106 SM490A (Equivalent to A36)	

Table6 Welding condition and pass sequence

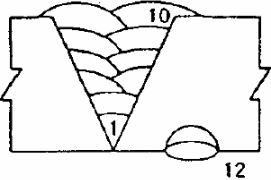
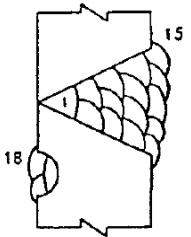
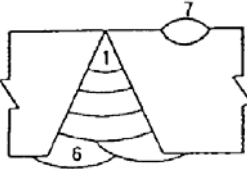
Welding position	Welding condition	Ave. HIP (kJ/in.)	Pass sequence
1G	1 st pass : 200A - 24V 2 nd pass and later: 270A -28V	34.0	
2G	1 st pass : 170A -23V 2 nd – 14 th pass : 280A - 28V 15 th pass and later : 250A - 26V	22.9	
3G	1 st pass : 150A - 22V 2 nd pass and later: 210A -24V	54.1	

Table7 Charpy absorbed energy (ft-lbs) *1

Welding position	As weld			1150°F × 3Hrs		
	-76°F	-40°F	0°F	-76°F	-40°F	0°F
1G	51<44,59,49> (69<59,80,67>)	64<69,56,68> (87<94,76,92>)	84<87,84,82> (114<118,114,111>)	38<48,35,31> (52<65,48,42>)	58<52,63,57> (78<71,85,77>)	63<53,72,65> (86<72,97,88>)
2G	37<45,34,33> (51<61,46,45>)	46<47,51,38> (62<64,69,52>)	91<67,61,74> (124<91,83,100>)	20<13,41,13> (27<18,55,18>)	35<30,30,43> (47<41,41,58>)	51<49,48,55> (69<66,65,75>)
3G	20<19,23,17> (27<26,32,23>)	41<33,46,45> (56<45,63,61>)	66<73,59,65> (89<98,80,88>)	18<18,10,27> (25<25,13,36>)	35<49,21,35> (48<67,29,47>)	68<58,72,73> (92<78,98,99>)

*1: Location of specimen: center of thickness, *2: Unit for digit in parenthesis (): J

Table8 Chemical composition of welded joint (mass%)

Welding position	C	Mn	Si	P	S	Ni
1G	0.06	1.36	0.46	0.011	0.007	0.41
2G	0.06	1.39	0.48	0.010	0.007	0.40
3G	0.06	1.31	0.44	0.010	0.007	0.40

4. Diffusible hydrogen content (0.045in. , 1/16in.)

The diffusible hydrogen content tested with both gases in accordance with AWS 5.20 is shown in Table9.

Table9 Typical diffusible hydrogen content in weld metal *1

Diameter inch	Diffusible hydrogen content ml/100g depo				
	N=1	N=2	N=3	N=4	Ave.
0.045	3.8	4.0	4.2	3.7	3.9
1/16	4.3	4.0	4.4	4.4	4.3

*1 Welding position: Flat. Welding condition: 230A (0.045in), 260A (1/16in). Wire-stick out: 1in. (25mm)

5. Fume generation rate (0.045in. 1/16in.)

The fume generation rate with both gases was investigated according to the condition shown in Table10.

Table10 Typical fume generation rate (Lbs/Hr) *1

Diameter inch (mm)	Welding current (A)				
	180	220	260	300	340
0.045	0.043	0.059	0.070	0.069	-
1/16	-	0.056	0.081	0.089	0.101

*1 Welding position: Flat. Wire-stick out: 1in.(25mm).

6. Usage

Table10 Welding position and proper range of welding current (A)

Diameter (in.) Welding position	0.045	1/16
Flat	120 - 300	180 - 450
Vertical upward	120 - 260	180 - 280
Vertical downward	200 - 300	250 - 300
Horizontal	120 - 300	200 - 400
Overhead	120 - 260	180 - 280
Horizontal fillet	120 - 300	200-400

7. Recommended welding conditions

Table Welding position and proper range of welding current

Diameter (in.)	Wire Feeding Speed (in/min)	Current (A)	Voltage (V)	Deposition Rate (lbs/hr)	WSO (in.)	Guideline of HIP (kJ/in.)
0.045	180	140	24-27	5.0	5/8-3/4	≤ 70
	200	160	25-28	6.0		
	245	180	26-29	7.0		
	290	200	27-30	8.0		
	330	220	27-30	9.0		
	380	240	28-30	10.0		
	440	260	29-31	11.5		
	520	280	29 -31	13.0		
1/16	145	200	25-27	6.0	3/4-1	≤ 70
	200	260	27-30	8.0		
	295	320	30-34	11.5		
	380	380	32-36	14.0		
	500	440	33-37	18.5		