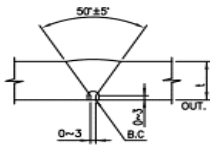


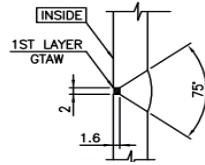
WELDING PROCEDURE SPECIFICATION

WPS No.	<u>WPS-HX127-001</u>
Rev.	1
PQR No.	<u>FPA-PQR-029</u>

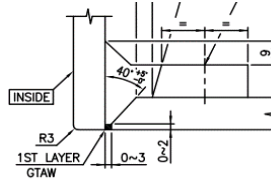
Joint Prep.: Machining/ Grinding



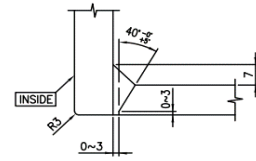
LWL-1~LWL-4



T1-a,T1-b,T2-a,T2-b,S1-a,S1-b,S2-a,PSV-a,LG1-a,LG2-a,S3-a,LG1-b,LG1-c,LG2-b,LG2-c,T1-a,T1-b,T2-a,T2-b



T1,T2,S1,S2,PSV



LG1,LG2,D1,D2 ,S3,V

QW-403 Base Material

SA-516 Gr.70N,SA-333 Gr.6, SA-105N, SA-234 WPB6, SA420 WPL6	to	SA-516 Gr.70N, SA-106 Gr.B,SA-350 LF2,SA-105N,SA-234 WPB6	Thk. Qualified	5~50 mm
P No. 1	Gr. No. 1,2	P No. 1	Dia. Qualified	N.A
		Gr. No. 1,2	Fillet Weld	N.A

QW-405 Welding Process

Zone or Layer	1	2
Welding Process	GTAW	SMAW
Type	MANUAL	MANUAL
Max. Weld Metal THK.(mm)	6mm	22mm
Max. Weld Metal THK per pass.(mm)	13mm	13mm
Welding Position	ALL POSITION	ALL POSITION
Backing	NO	YES

QW-404 Filler Metal & Backing

Type	Trade Name	Dia(mm)	Supplier	S.F.A	F No.	A No.	AWS Classification
Solid(Tig) Wire	ST-50.6	2.4	HYUNDAI	5.18	6	1	ER70S-6
Electrode	S-7018.1H	3.2,4	AMA	5.1	4	1	E7018-1

NOTE: HYUNDAI OR EQUIVALENT

QW-409 Welding Parameter

Process	Φ mm	Polarity Type	Parameters			Travel speed (cm/min)	Heat input (kj/cm)
			wire speed	Amper(A)	Volt(v)		
GTAW (ROOT)	2.4	DCEN	-	100~120	10~14	8~10	-
SMAW	3.2	DCEP	-	140~160	22~26	18~21	-
SMAW	4	DCEP	-	150~170	25~28	19~23	-

QW-410 Technique

Bead Type	STRING	Current Type	DC	Shielding Gas	Ar99.98%
Osillation	NO	Electrode Spacing	N.A.	Flow Rate L/min	10~12
Welding Progression	Uphill	Φ Tungst & type	2.4 & EWTb-2	AWS Classified	A5.32 SG-A
Stick-Out(mm)	NA	Orifice Gas	N.A	Backing Gas	N.A
Single or multiple elect.	SINGLE	Peening	No	Flow Rate L/min	N.A
Multipass or Singlepass	MULTIPASS	Cleaning	Brushing,Grinding	Trailing Gas	N.A
Transfer Mode	N.A.	Back Gouge Method	Grinding	Flow Rate L/min	N.A

Note:

QW-406 & QW-407 Preheating & PWHT

Preheat temp.(min °C)	25	Method of heating	By Flame
Interpass tem.(Max. °C)	250	Method of checking	Tempilstick
Postheating & Time(°C & h)	-		
Post weld heat treatment(°C & h)	-	Aplicable procedure	-

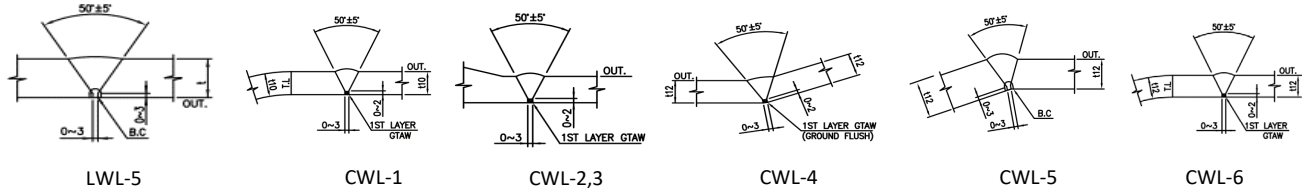
Prepared By

Reviewed By Owner

WELDING PROCEDURE SPECIFICATION

WPS No.	WPS-HX127-002
Rev.	1
PQR No.	FPA-PQR-029

Joint Prep.: Machining/ Grinding



QW-403 Base Material

SA-516 Gr.70 N	to	SA-516 Gr.70 N,SA-106 Gr.B	Thk. Qualified	5~50 mm
P No. 1	Gr. No. 2	P No. 1	Dia. Qualified	N.A
		Gr. No. 1,2	Fillet Weld	N.A

QW-405 Welding Process

Zone or Layer	1	2	3
Welding Process	GTAW	SMAW	SAW
Type	MANUAL	MANUAL	SEMI-AUTOMATIC
Max. Weld Metal THK.(mm)	6mm	22mm	22 mm
Max. Weld Metal THK per pass.(mm)	13mm	13mm	13mm
Welding Position	ALL POSITION	ALL POSITION	1G
Backing	NO	YES	YES

QW-404 Filler Metal & Backing

Type	Trade Name	Dia(mm)	Supplier	S.F.A	F No.	A No.	AWS Classification
Solid(Tig) Wire	ST-50.6	2.4	HYUNDAI	5.18	6	1	ER70S-6
Electrode	S-7018.1H	4	HYUNDAI	5.1	4	1	E7018-1
Wire (SAW)	M-12K	4	HYUNDAI	5.17	6	1	EM12K
Flux for SAW	S-717	-	HYUNDAI	-	-	-	F7A6

NOTE: HYUNDAI OR EQUIVALENT

QW-409 Welding Parameter

Process	Φ mm	Polarity Type	Parameters			Travel speed (cm/min)	Heat input (kj/cm)
			wire speed	Amper(A)	Volt(v)		
GTAW (ROOT)	2.4	DCEN	-	100~120	10~14	10~12	-
SMAW	4	DCEP	-	140~160	22~26	18~21	-
SAW	4	DCEP	-	400~450	28~31	40~50	-

QW-410 Technique

Bead Type (String or Weave)	Both	Current Type	DC	Shielding Gas	Ar99.98%
Oscillation	NO	Electrode Spacing	N.A.	Flow Rate L/min	10~12
Welding Progression	Uphill	Φ Tungst & type	2.4 & EWTb-2	AWS Classified	A5.32 SG-A
Stick-Out(mm)	10-20mm	Orifice Gas	10mm	Backing Gas	N.A
Single or multiple elect.	SINGLE	Peening	No	Flow Rate L/min	N.A
Multipass or Singlepass	MULTIPASS	Cleaning	Brushing,Grinding	Trailing Gas	N.A
Transfer Mode	N.A.	Back Gouge Method	Grinding	Flow Rate L/min	N.A

Note:

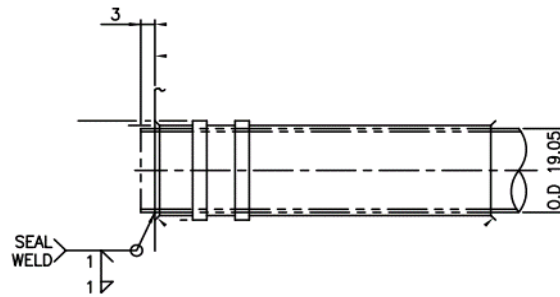
QW-406 & QW-407 Preheating & PWHT

Preheat temp.(min°C)	25	Method of heating	By Flame
Interpass tem.(Max.°C)	250	Method of checking	Tempilstick
Postheating & Time(°C& h)	-		
Post weld heat treatment(°C& h)	-	Applicable procedure	-

Prepared By	Reviewed By Owner

WELDING PROCEDURE SPECIFICATION	WPS No.	<u>WPS-HX127-003</u>
	Rev.	1
	PQR No.	<u>FPA-PQR-104</u>

Joint Prep.



Tube to Tube Sheet

QW-403 Base Material

SA-334-6				to	SA-350-LF2				Thk. Qualified	1.05:4.22
P No.	1	Gr. No.	1		P No.	1	Gr. No.	2	Dia. Qualified	N.A
									Fillet Weld	N.A

QW-405 Welding Process

Zone or Layer	1		
Welding Process	GTAW		
Type	Automatic		
Max. Weld Metal.(mm)	3mm		
Welding Position	5G		
Backing	YES		

QW-404 Filler Metal & Backing

Type	Trade Name	Dia(mm)	Supplier	S.F.A	F No.	A No.	AWS Classification
Wire	-	0.8	Bohler	5.18	6	1	ER70S-6

QW-409 Welding Parameter

Process	Φ mm	Polarity Type	Parameters			Travel speed (cm/min)	Heat input (kj/cm)
			wire speed	Amper(A)	Volt(v)		
GTAW	0.8	DCEN	-	80-160	8-12	5-7	-

QW-410 Technique

Bead Type	STRING	Current Type	DC	Shielding Gas	Ar 99.98%
Osillation	NO	Electrode Spacing	N.A.	Flow Rate L/min	10~12
Welding Progression	N.A	Φ Tungst & type	2.4 & EWTh-2	AWS Classified	A5.32 SG-A
Stick-Out(mm)	N.A	Orifice Gas	-	Backing Gas	N.A
Single or multiple elect.	SINGLE	Penning	No	Flow Rate L/min	N.A
Multipass or Singlepass	MULTIPASS	Cleaning	Brushing	Trailing Gas	N.A
				Flow Rate L/min	N.A

Note:

-100% PT shall be done after back gouging.

QW-406 & QW-407 Preheating & PWHT

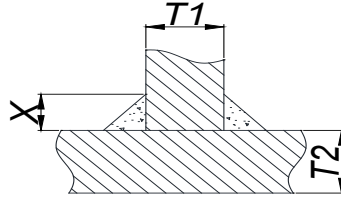
Preheat temp.(min°C)	20	Method of heating	By Flame
Interpass tem.(Max.°C)	220	Method of checking	Tempilstick
Postheating & Time(°C& h)	-		
Post weld heat treatment(°C& h)	-	Aplicable procedure	-

Prepared by FPA

Reviewed By Owner

WELDING PROCEDURE SPECIFICATION	WPS No.	WPS-HX127-004
	Rev.	1
	PQR No.	FPA-PQR-029

Joint Prep.



FW1,FW2,FW3

QW-403 Base Material

SA-516 Gr.70,SA-283 Gr.C				to	SA-516 Gr.70				Thk. Qualified	5~50 mm
P No.	1	Gr. No.	1,2		P No.	1	Gr. No.	2	Di. Qualified	ALL
									Fillet Weld	ALL

QW-405 Welding Process

Zone or Layer	1~N		
Welding Process	SMAW		
Type	MANUAL		
Max. Weld Metal THK.(mm)	ALL		
Max. Weld Metal THK per pass.(mm)	13mm		
Welding Position	1G		
Backing	Yes		

QW-404 Filler Metal & Backing

Type	Trade Name	Dia(mm)	Supplier	S.F.A	F No.	A No.	AWS Classification
Electrode	S-7018.1H	3.2,4	HYUNDAI	5.1	4	1	S-7018.1H

NOTE: AMA OR EQUIVALENT

QW-409 Welding Parameter

Process	Φ mm	Polarity Type	Parameters			Travel speed (cm/min)	Heat input (kj/cm)
			wire speed	Amper(A)	Volt(v)		
SMAW(Root)	3.2	DCEP	-	120~140	22~25	16~19	-
SMAW	4	DCEP	-	140~170	25~28	18~21	-

QW-410 Technique

Bead Type	STRING	Current Type	N.A	Shielding Gas	N.A
Osillation	NO	Electrode Spacing	N.A	Flow Rate L/min	N.A
Welding Progression	N.A	Φ Tungst & type	N.A	AWS Classified	N.A
Stick-Out(mm)	N.A	Orifice Gas	N.A	Backing Gas	N.A
Single or multiple elect.	SINGLE	Penning	No	Flow Rate L/min	N.A
Multipass or Singlepass	MULTIPASS	Cleaning	Brushing& Grinding	Trailing Gas	N.A
Transfer Mode	N.A.	Gas		Flow Rate L/min	N.A

Note:

QW-406 &QW-407 Preheating & PWHT

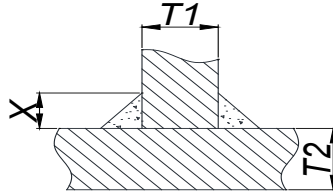
Preheat temp.(min°C)	25	Method of heating	By Flame
Interpass tem.(Max.°C)	250	Method of checking	Tempilstick
Postheating & Time(°C& h)	-		
Post weld heat treatment(°C& h)	-	Aplicable procedure	-

Prepared By

Reviewed By Owner

WELDING PROCEDURE SPECIFICATION	WPS No.	<u>WPS-HX127-005</u>
	Rev.	1
	PQR No.	<u>FPA-PQR-027</u>

Joint Prep.



FW1,FW2,FW3

Fillet Weld,Leg

QW-403 Base Material

SA-516 Gr.70,SA-283 Gr.C				to	SA-516 Gr.70				Thk. Qualified	-
									Dia. Qualified	N.A
P No.	1	Gr. No.	1,2		P No.	1	Gr. No.	2	Fillet Weld	ALL

QW-405 Welding Process

Zone or Layer	1		
Welding Process	GMAW		
Type	SEMI-AUTOMATIC		
Max. Weld Metal THK.(mm)	ALL FOR FILLET		
Max. Weld Metal THK per pass.(mm)	13mm		
Welding Position	ALL POSITION		
Backing	Yes		

QW-404 Filler Metal & Backing

Type	Trade Name	Dia(mm)	Supplier	S.F.A	F No.	A No.	AWS Classification
MIG WIRE		1.2	-	5.18	6	1	ER70S-6

QW-409 Welding Parameter

Process	Φ mm	Polarity Type	Parameters			Travel speed (cm/min)	Heat input (kj/cm)
			wire speed	Amper(A)	Volt(v)		
GMAW	1.2	DCEP	-	185~250	22~28	18~25	-
GMAW	1.2	DCEP	-	185~250	22~28	18~25	-

QW-410 Technique

Bead Type	STRING	Current Type	N.A	Shielding Gas	100%CO2
Osillation	NO	Electrode Spacing	N.A	Flow Rate L/min	15-20
Welding Progression	N.A	Φ Tungst & type	N.A	AWS Classified	N.A
Stick-Out(mm)	10-20	Orifice Gas	N.A	Backing Gas	N.A
Single or multiple elect.	SINGLE	Penning	No	Flow Rate L/min	N.A
Multipass or Singlepass	MULTIPASS	Cleaning	Brushing& Grinding	Trailing Gas	N.A
Transfer Mode	GLOBULAR	Gas	-	Flow Rate L/min	N.A

Note:

QW-406 & QW-407 Preheating & PWHT

Preheat temp.(min°C)	25	Method of heating	By Flame
Interpass tem.(Max.°C)	250	Method of checking	Tempilstick
Postheating & Time(°C& h)	-		
Post weld heat treatment(°C& h)	-	Aplicable procedure	-

Prepared By

Reviewed By Owner