

INTEGRAL COACH FACTORY, CHENNAI-38			ICF/MD/SPEC.-182	
SCHEDULE OF TECHNICAL REQUIREMENTS FOR ALUMINIUM WELDING			ISSUE STATUS : 01	
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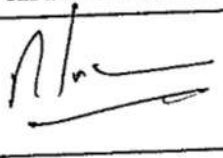
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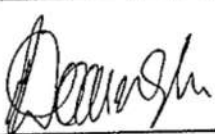

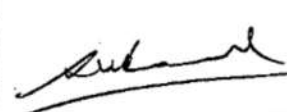
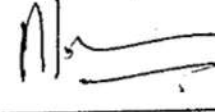
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INTEGRAL COACH FACTORY, CHENNAI-38	ICF/MD/SPEC-182 ISSUE STATUS:01 REV. No.00 Date : 19-12-2005
SCHEDULE OF TECHNICAL REQUIREMENTS FOR ALUMINUM WELDING	
AMENDMENT SLIP NO. : 01 DATED.25-05-06	No. of Pages: 1

PAGE	CLAUSE	EXISTING	REVISED
1	4.1.2	3. 0.3 to 0.5 % Zirconiated Tungsten electrode of suitable diameter, pointed	3. 1% Zirconiated Tungsten electrode of suitable diameter, pointed

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR ALUMINIUM WELDING**ICF/MD/SPEC-182****Issue status :01****Rev.00****Page 1 of 12****1.0 SCOPE**

- 1.1 This specification covers the requirements for manufacture and supply of aluminum welding components by TIG welding.
- 1.2 All vendors seeking approval with Integral Coach Factory to supply aluminum welded items with TIG welding must fulfill the requirements given below in this schedule.

2.0 Weld Joint and welder qualification

- 2.1 The firm must have Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) according to AWS D 15.1-86 Railroad Welding Specification or Section IX of ASME Boiler and Pressure Vessel Code.
- 2.2 The firm must have Welder Performance Qualification procedure to qualify welder according to AWS D 15.1-86 Railroad Welding Specification or Section IX of ASME Boiler and Pressure Vessel Code.

3.0 Third Party Inspection

- 3.1 The firm shall get a third party inspection for the certification of Welding procedure specification and Procedure Qualification Record.
- 3.2 The firm shall get the Welder Performance Qualification approved by a third party.
- 3.3 The third party for clause 3.1 and 3.2 shall be reputed firms like M/s Lloyds Register of Shipping, M/s TUV, M/s BVQI, M/s DNV etc.

4.0 MANUFACTURING FACILITIES:**4.1 PLANT & MACHINERY:** The firm must have :-

- 4.1.1 Portable angle grinder or sander with attachments for surface cleaning.

4.1.2 Gas Tungsten Arc Welding (GTAW) Equipment comprising of :-

1. AC Power Source
2. GTAW Torch with water / air cooling arrangement.
3. 0.3 to 0.5 % Zirconiated Tungsten electrode of suitable diameter, pointed
4. Gas Cup made of ceramic, metal and high-temperature glasses.
5. Cylinders for storage of inert gas
6. High Frequency Start equipment

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- 4.2 FIXTURES:** The firm should have fixtures as per requirement, to ensure better dimensional control.
- 4.3 TESTING FACILITY:** The firm must have facility for liquid penetration examination and qualified personnel for performing the test.
- 4.4 INSPECTION FACILITY:** The firm must have calibrated measuring tape, screw gauge, Vernier caliper, throat gauge etc
- 5.0 COVERED AREA:** The firm should have adequate covered area for working and storage of raw material and work-in-progress
- 6.0 QUALITY ASSURANCE PLAN:**
- 6.1** The firm shall be ISO 9001 accredited.
- 6.2** The firm shall have a system of
- Inspection of raw material
 - Transfer of stamp
 - Inspection of fit/ set up
 - Inspection of root run.
 - Inspection of final weld.

7.0 Recommended parameters for aluminum welding for water tanks

1	Electrode	0.3 to 0.5 % Zirconiated tungsten
2	Tip of electrode	Annexure – D, Figure 1
3	Electrode diameter	3.15 mm
4	Current	AC
	Root run(in AMPERES)	70-115
	Filler run(in AMPERES)	120-140
5	Gas flow rate	720 litres/ hour
6	Arc travel speed	20 cm/ minute
7	Shield diameter	12.5 mm
8	Shielding Gas	Pure argon
9	Filler wire	NG 21
10	Edge preparation	Annexure – D , Figure 2

- 8.0** Samples of WPS, PQR and welder performance qualification are given at Annexure A, B and C respectively.

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Welding Procedure Specification (WPS)

Annexure - A

Company Name		By	
WPS Number		Date	
Supporting PQR number			
Revision number		Date	
Welding Process(es)		Type(s)	
		Automatic/manual/machine/Semi auto	

Joints

Joint Design	Detail
<p>Sketches, production drawings, weld symbols, written description should show the general arrangements of the parts to be welded.</p> <p>Where applicable, the root spacing and the details of weld groove may be specified.</p> <p>(At the option of the manufacturer, sketches may be attached to illustrate joint design, weld layers and bead sequence eg for notch toughness procedures, for multiple process procedures etc)</p>	

Base metal

Specification type and grade	
To specification type and grade	

Thickness Range

Base metal	Groove		Fillet	
Pipe Diameter	Groove		Fillet	
Range				
Other				

*FILLER METAL

SPEC NO			
AWS NO(CLASS)			

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FILLER MATERIAL ANALYSIS F NO			
WELD METEL ANALYSIS A NO			
SIZE OF FILLER METAL			
THICKNESS RANGE			
Groove			
Fillet			
Electrode -flux (Class)			
Flux trade name			
Other			
* Each base metal filler metal combination should be recorded individually			

POSITIONS

Position(s) of Groove			
Welding Progression	Up		Down
Position(s) of fillet			

GAS

Percent composition			
	Gas	mixture	Flow rate
Shielding			
Trailing			
Backing			

ELECTRICAL CHARACTERISTICS

Current (AC/DC)		Polarity OF JOB (IF DC)	
Amps(Range)		Volts (Range)	
Amps and volts range should be recorded for each electrode size, position, and thickness, etc This information may be listed in a tabular form similar to that shown below.			
Tungsten electrode Size and type			
Mode of transfer for GMAW			
Electrode wire feed, speed range			

TECHNIQUE

String or weave bead		
Orifice or gas cup size		
Initial and inter pass		

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cleaning (Brushing, grinding etc.,)		
Method of back gouging		
Oscillation		
Contact tube to work distance (Stick out)		
Multiple or single pass (per side)		
Multiple or single electrodes		
Travel speed (Range)		
Peening		
Other		

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Annexure – B

PROCEDURE QUALIFICATION RECORD

Company Name		By	
Procedure Qualification Record Number		Date	
Reference WPS number			
		Date	
Welding process(es)		Type(s)	
		Automatic/manual/machine/Semi auto	

Joints

Joint Design	Detail
<p>Sketches, production drawings, weld symbols, written description should show the general arrangements of the parts to be welded.</p> <p>Where applicable, the root spacing and the details of weld groove may be specified.</p> <p>(At the option of the manufacturer, sketches may be attached to illustrate joint design, weld layers and bead sequence eg for notch toughness procedures, for multiple process procedures etc)</p>	

Base metal

Specification type and grade	
To specification type and grade	

Thickness of Test Coupon

Base metal	Groove		Fillet	
Pipe Diameter Range	Groove		Fillet	
Other				

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***Filler metal**

Spec No			
AWS no(class)			
Filler metal F NO			
Weld metal A NO			
Size of filler metal			
Thickness range			
Groove			
Fillet			
Electrode -flux (Class)			
Flux trade name			
Other			
* Each base metal filler metal combination should be recorded individually			
Others			
Deposited weld metal			

POSITIONS

Position(s) of Groove			
Welding Progression	Uphill		Downhill
Position(s) of fillet			

GAS

Percent composition			
	Gas	mixture	Flow rate
Shielding			
Trailing			
Backing			

Electrical Characteristics

Current (AC/DC)		Polarity	
Amps(Range)		Volts (Range)	
Amps and volts range should be recorded for each electrode size, position, and thickness, etc This information may be listed in a tabular form similar to that shown below.			

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Tungsten electrode Size and type				
Mode of metal transfer for GMAW				
Electrode wire feed, speed range				

TECHNIQUE

Travel speed		
String or weave bead		
Initial and inter pass cleaning (Brushing, grinding etc.,)		
Method of back gouging		
Oscillation		
Multiple or single pass (per side)		
Multiple or single electrodes		
Other		

Tensile Test

Specimen number	Width	Thickness	Area	Ultimate total load	Ultimate unit stress	Type of failure and location

Guided Bend Test

TYPE & FIGURE NO.	

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Toughness Tests

Specimen no.	Notch Location	Notch type	Test temp	Impact	Lateral Exp.		Drop Weight	
							Break	No Break

Fillet Weld Test

Result		
Satisfactory	Yes	No
Penetration into parent metal	Yes	No
Macro Examination result		

Other Tests

Type of test	
Deposit analysis	
Other	

Welder's Name	T.No:	Clock no	E.No:	Stamp No	
Test Conducted by			Laboratory test no		

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of

Manufacturer		By	
Date			

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Annexure - C

SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER OR WELDING OPERATOR QUALIFICATION TESTS (WPO)

Clock numberStamp no.....

Welder's name.....

Welding process(es) used.....Type

Identification of WPS followed by welder during welding of test coupon.....

Base material(s) welded.....Thickness.....

Manual or semiautomatic variables for each process	Actual Values	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc)		
ASME P.NO to ASME P.NO		
() plate () pipe (Enter diameter, if pipe)		
Filler metal specification (SFA) Classification		
Filler metal F NO		
Consumable insert for GTAW or PAW		
Weld deposit thickness for each welding process		
Welding position		
Progression		
Backing gas for GTAW, PAW or GMAW		
GMAW transfer mode		
GTAW welding current type / polarity		

Machine welding variables for the process used	Actual values	Range qualified
Direct / remote visual control		
Automatic voltage control (GTAW)		
Automatic joint tracking		
Welding position (IG, BG etc.,)		
Consumable insert		
Backing (metal, weld metal, welded from both sides flow etc.,		

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Guided Bend Test results

Guided bend Tests Type ()

Radiographic test Results

(For alternative qualification of groove welds by radiography)

Filler weld- fracture test		
Length and percent of defects		
Macro Test		
Fusion		
Fillet leg size		
Concavity /convexity		
Welding test conducted by		
Laboratory test no		

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Section IX of the ASME code

Organisation.....

Date:

By

ABBREVIATIONS USED

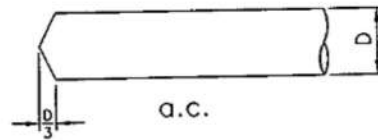
WPS	Welding Procedure Specification
PQR	Process Qualification Record

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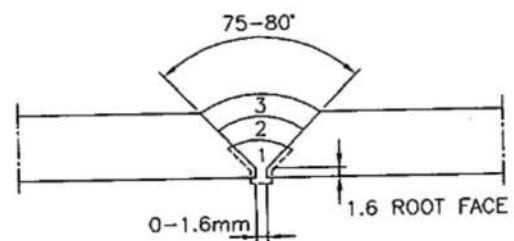
ANNEXURE-D

FIGURE-1



Tungsten electrode preparation

FIGURE-2



Manual TIG process: Preparation of aluminium and aluminium alloy plate, Single V butt joints.