# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF II. Type 1 Revision _____ Company / Organization NIKHEF.

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc.

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade Dynatube connector 15-5 PH to Material spec., type, & grade CRES 347

Base metal thickness range _____

Pipe / Tube diameter 4,76 mm Wall thickness 0,7 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99,996% Flow Rate 6 LPM

Prepurge Time 20 Postpurge Time 20

Backing gas(es) Ar

% Composition 99,996% Flow rate _____

Prepurge Time 20 Postpurge Time 20

back pressure 177 mm $H_2O$

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Swagelok series 5.

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0,64 mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

electrode C.040 – .605.

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A.

Postweld HeatTreatment _____

### WELD SETTINGS :

Start current (amps) 13,3 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 5,0 (s)

Start Delay (sec.) 0,3 (s) Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 12,14

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type sleeve butt

Groove angle _____ Radius _____ Land _____

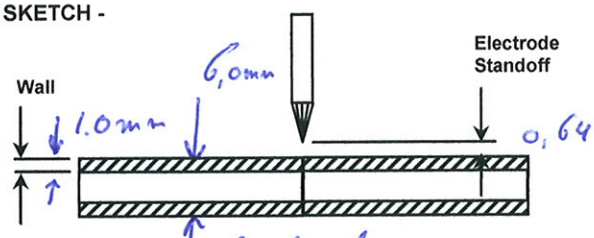
Root opening _____ Size of fillet _____

Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | HIGH Nominal | HIGH -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 16,7. | | | 7, | 33 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

### SKETCH -

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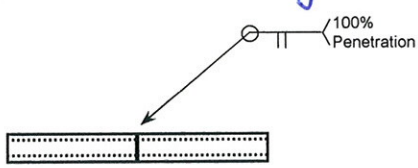


### TECHNIQUE :

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 the NASA / JSC PRC-0010.

Qualifier : E. Roeland Reviewed by : J.v. Es NLR 13/10/2009 JVE

Date : 13-10-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF II Type ~~1~~, 2 Revision _____ Company / Organization _____

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc

**BASE and FILLER METAL :**

Material number CRES 347 Group _____ to Material number 316L Group Microgroup batch.

Material spec., type, and grade _____ to Material spec., type, & grade _____

Base metal thickness range _____

Pipe / Tube diameter 4,0 mm Wall thickness 0,7 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

**GAS :**

Torch gas(es) Ar.

% Composition 99,996% Flow Rate 6 LPM

Prepurge Time 20 (s) Postpurge Time 20 (s)

Backing gas(es) Ar

% Composition 99,996% Flow rate 6 LPM

Prepurge Time 20 (s) Postpurge Time 20 (s)

back pressure 17 mm $H_2O$

**WELDING SET-UP :**

Power Supply (Model) Swagelok M100

Weld Head(s) Swagelok series 5H

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0,64

Tip diameter ⊘ Tip angle _____

Weld direction _____ Pulse Mode _____

Electrode C.040 – 0.705.

**PRE and POSTWELD HEAT :**

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A

**WELD SETTINGS :**

Start current (amps) 13,3 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 5,0

Start Delay (sec.) 0,3 Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 12,13

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

**JOINT DESIGN :**

Joint type Square butt.

Groove angle _____ Radius _____ Land _____

Root opening _____ Size of fillet _____

Socket weld pull-back _____

**NOMINAL HEAT INPUT CONDITIONS :**

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | HIGH Nominal | HIGH -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 11,5 | | | 7 | 25 |
| | | | | | | | |
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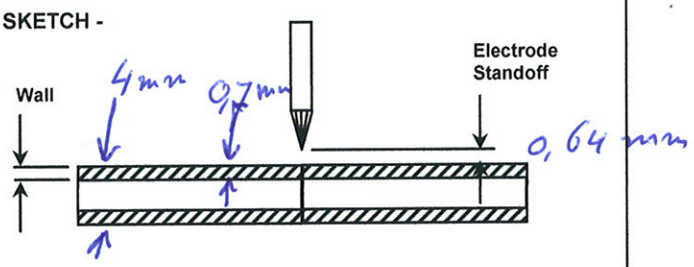
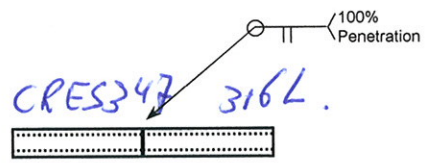
**SKETCH -**

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Date : 13-10-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF II Type IV Revision _____ Company / Organization _____

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade 316L Microgroup to Material spec., type, & grade 316L NIKHEF batch

Base metal thickness range _____

Pipe / Tube diameter 4,0 Wall thickness 0,7 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99,996% Flow Rate 4 LPM

Prepurge Time 20 Postpurge Time 20

Backing gas(es) Ar

% Composition 99,996% Flow rate _____

Prepurge Time 20 Postpurge Time 20

177 mm $H_2O$

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Swagelok series 400 4MFH

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0,64 mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

Electrode Co.040 - 0,705

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A.

### WELD SETTINGS :

Start current (amps) 13,3 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 3,7(S)

Start Delay (sec.) 0,3 Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 16,17

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type square butt

Groove angle _____ Radius _____ Land _____

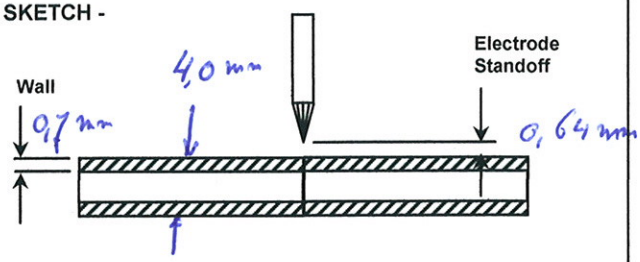
Root opening _____ Size of fillet _____

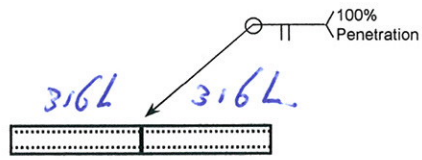
Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | HIGH Nominal | HIGH -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 13,3 | | | 10 | 25 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

### SKETCH -

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Qualifier : E. Roeland Reviewed by : J. v. Es 15/10/2009 JvE

Date : 15-10-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF II ~~Semess~~ Type V Revision _____ Company / Organization NIKHEF

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade 316L Microgroup to Material spec., type, & grade 316L Condenser Manifold

Base metal thickness range _____

Pipe / Tube diameter 4.0 Wall thickness 0,7 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99,996% Flow Rate 4LPM.

Prepurge Time 20 Postpurge Time 20

Backing gas(es) Ar

% Composition 99,996% Flow rate _____

Prepurge Time 20 Postpurge Time 20

177 mm $H_2O$

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Swagelok series 400

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1mm Arc gap 0,64mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

Electrode CO.040 – 0.405.

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A

### WELD SETTINGS :

Start current (amps) 13,3 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 3,7 (s)

Start Delay (sec.) 0,3 (s) Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 16,17

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type square butt

Groove angle _____ Radius _____ Land _____

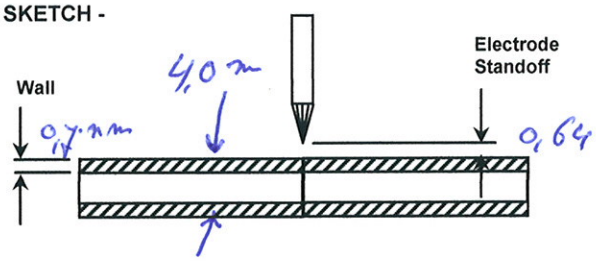
Root opening _____ Size of fillet _____

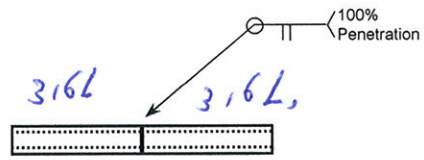
Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) HIGH +5% | Nominal | -5% | Settings LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 13,4 | | | 10 | 25. |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

### SKETCH -

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Qualifier : E. Roeland Reviewed by : J. v. Es 10/11/2009 JvE

Date : 10-11-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number _____ Revision _____ Company / Organization NIKHEF

Supporting WPS no.(s) NIKHEF II. Type VI Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade CRES 347 to Material spec., type, & grade 316L standard Rockwelder

Base metal thickness range _____

Pipe / Tube diameter 6,0 Wall thickness 1,0 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99.996% Flow Rate 4 LPM

Prepurge Time 20 Postpurge Time 20

Backing gas(es) Ar

% Composition 99.996% Flow rate _____

Prepurge Time 20 Postpurge Time 20

177 mm $H_2O$

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Serrek 400 4MFH

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0,76 mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

CO.40 – 0.325

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A

### WELD SETTINGS :

Start current (amps) 26,63 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 1,3 (s)

Start Delay (sec.) 0,6 (s) Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 10,11

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type square butt

Groove angle _____ Radius _____ Land _____

Root opening _____ Size of fillet _____

Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | Nominal | -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 26,6 | | | 6 | 25 |
| | | | | | | | |
| | | | | | | | |
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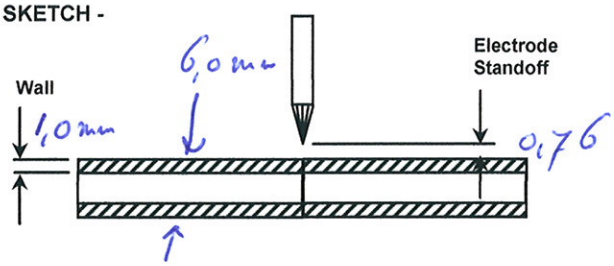
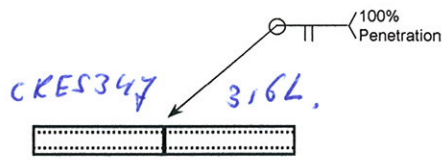
### SKETCH -




### TECHNIQUE :

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Qualifier : E. Roeland Reviewed by : J. v. Es 16/10/2009 JvE

Date : 16-10-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF-II Type VII Revision _____ Company / Organization _____

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade Swagelok coupling VAR316L VIMVAR to Material spec., type, & grade 316L Standard Dockweiler

Base metal thickness range _____

Pipe / Tube diameter 6.0 Wall thickness 1.0 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99.996% Flow Rate 4 LPM

Prepurge Time 20 (s) Postpurge Time 20 (s).

Backing gas(es) Ar

% Composition 99.996% Flow rate _____

Prepurge Time _____ Postpurge Time _____

back pressure 177 mm $H_2O$.

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Series 400 4MFH

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0.76 mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

Electrode C.040 _ .325.

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A

### WELD SETTINGS :

Start current (amps) 26.3 Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 1.3 (s)

Start Delay (sec.) 0.6 (s) Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 10.21

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type square butt

Groove angle _____ Radius _____ Land _____

Root opening _____ Size of fillet _____

Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | Nominal | -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | | 26.2 | | | 6 | 25. |
| | | | | | | | |
| | | | | | | | |
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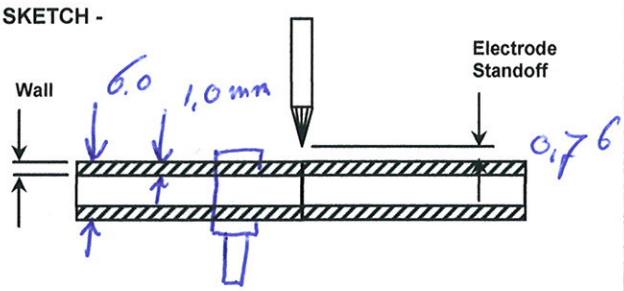
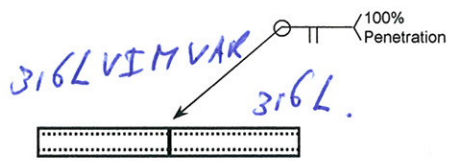
### SKETCH -

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Qualifier : E. Roeland Reviewed by : S. v. Es 13/10/2009 JvE

Date : 13-10-2009 Approved by : _____

# NIKHEF Nationaal instituut voor subatomaire fysica, Amsterdam

## ORBITAL TUBE GAS TUNGSTEN ARC WELDING PROCEDURE QUALIFICATION RECORD (PQR)

PQR Number NIKHEF II Type VIII Revision _____ Company / Organization NIKHEF.

Supporting WPS no.(s) _____ Welding Process(es) Automatic Orbital Tube Gas Tungsten Arc.

### BASE and FILLER METAL :

Material number _____ Group _____ to Material number _____ Group _____

Material spec., type, and grade CRES347 to Material spec., type, & grade 316L standard Dockweiler

Base metal thickness range _____

Pipe / Tube diameter 6,0 Wall thickness 1,0 mm

Filler metal F No. _____ AWS Class & Spec. _____

Consumable Insert, AWS Class & Spec. _____

### GAS :

Torch gas(es) Ar

% Composition 99,996 % Flow Rate 6 LPM

Prepurge Time 20 Postpurge Time 20

Backing gas(es) Ar

% Composition 99,996 % Flow rate _____

Prepurge Time 20 Postpurge Time 20

back pressure 177 mm $H_2O$

### WELDING SET-UP :

Power Supply (Model) Swagelok M100

Weld Head(s) Swagelok Series 5

Joint Position(s) _____

Tungsten type 2% ceriated Diameter 1 mm Arc gap 0,76 mm

Tip diameter _____ Tip angle _____

Weld direction _____ Pulse Mode _____

electrode C.040 - 0,705

### PRE and POSTWELD HEAT :

Preheat temperature minimum RT

Preheat temperature maximum RT

Interpass temperature minimum N/A

Interpass temperature maximum N/A

Postweld HeatTreatment N/A.

### WELD SETTINGS :

Start current (amps) 26,3 Amps Upslope (sec.) _____

Level Slope Time (sec.) _____ Downslope (sec.) 1,3

Start Delay (sec.) 0,6 (s) Override (%) _____

Finish Current (amp) _____ Fixture Speed (RPM) 10,11

Weld Timer (on/off) _____ Step Mode (on/off) _____

Wire Mode (on/off) _____ Finish Current _____

### JOINT DESIGN :

Joint type butt weld

Groove angle _____ Radius _____ Land _____

Root opening _____ Size of fillet _____

Socket weld pull-back _____

### NOMINAL HEAT INPUT CONDITIONS :

| Level Number | Weld Time (sec.) | Allowable Current (amps) Settings HIGH +5% | HIGH Nominal | HIGH -5% | LOW Nominal | Pulse Rate (pps) | Pulse Width Nominal |
|---|---|---|---|---|---|---|---|
| | | 24,8 | 26,6 | 28,4 | | 6 | 25 |
| | | | | | | | |
| | | | | | | | |
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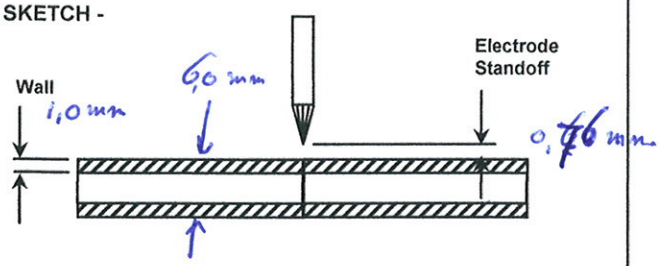
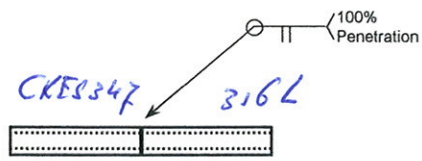
### SKETCH -

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Date : 10-11-2009 Approved by : _____