WELD PROGRAM OVERVIEW

COMPLIANCE

CONSTRUCTION

QUALITY CONTROL

WELD PROGRAM OVERVIEW

COMPLIANCE

49 CFR 192

SUBPART E – WELDING OF STEEL IN PIPELINES

192.221 SCOPE
192.225 WELDING PROCEDURES
192.227 QUALIFICATION OF WELDERS
192.229 LIMITATIONS ON WELDERS
192.231 PROTECTION FROM WEATHER
192.233 MITER JOINTS
192.235 PREPARATION FOR WELDING
192.241 INSPECTION AND TEST OF WELDS
192.243 NONDESTRUCTIVE TESTING
192.245 REPAIR OR REMOVAL OF DEFECTS

192.221 SCOPE

- MINIMUM REQUIREMENTS
  - WELDING OF STEEL MATERIALS IN PIPELINES
- LIMITS OF APPLICATION
  - DOES NOT APPLY TO MANUFACTURE OF STEEL PIPE & STEEL PIPELINE COMPONENTS

192.225 WELDING PROCEDURES

- WELDING PROCEDURES QUALIFIED UNDER
  - API 1104
  - ASME SECTION IX BOILER & VESSEL CODE
- QUALITY OF PROCEDURE TEST WELD
  - DETERMINED BY DESTRUCTIVE TESTING
- WELD PROCEDURE SPECIFICATION (WPS) DOCUMENTATION
  - RECORDED IN DETAIL INCLUDING DESTRUCTIVE TEST RESULTS
  - DESCRIPTION OF ESSENTIAL & NONESSENTIAL VARIABLES

WELDING PROCEDURE SPECIFICATION (WPS) 192.225

- WPS is a detailed written document that provides direction to the welder or welding operator for making production welds in accordance with code requirements. (CFR 49)
- WPS must be qualified by destructive testing to ensure welds with suitable properties (such as strength, ductility, and hardness) can be made by the procedure.
- WPS shall describe all essential, nonessential, and if applicable supplementary essentials variables.
- Any change to an essential variable requires Procedure Re-qualification

Tel : (662) 720-2166 (AUTO) Fax : (662) 720-2155

Welding Procedure Specification (WPS)
ASME IX

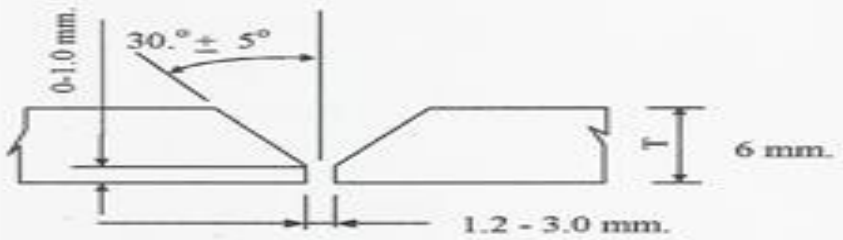
CLIENT : **Charoenchai Stainless Co.,Ltd.** *PROJECT :* **Fabrication Shop**

Welding Procedure Spec. No.:	CS-WPS-01	Date:	20 Jan 07	Supporting PQR No. (s) :	CS-PQR-01
Revision No. :	0	Date:	-		
Welding Process (es) :	GAS TUNGSTEN-ARC WELDING (GTAW)			Type :	Manual

JOINTS

Joint Design	Single Vee-Groove		
Backing	Yes ☐	No. ■	
Backing Materiel (Type)	N/A		
Root Opening :	1.2-3.0 mm.		
Root Face :	0- 1.0 mm.		
Groove Angle :	50°-70°	Radius (J-U)	N/A
Back Gouging :	Yes ☐	No. ■	
Method :	N/A		

DETAILS



T = Wall Thickness

BASE METALS (QW-403)

P. No.	8	Group No.	1	to P. No.	8	Group No.	1

Specification type and grade	SA-240 , TYPE 316L		
to Specification type and grade	SA-240 , TYPE 316L		
Thickness Range :			
Base Metal : Groove	1.5 mm. To 12.0 mm.	Fillet	All
Deposits Weld Metal	1.5 mm. To 12.0 mm.	Fillet	All
Pipe Dia. Range : Groove	Equal to or greater 24" (OD)	Fillet	All
Other	N/A		

FILLER METALS (QW-404)

F. No.	6	Other	N/A
A. No.	8	Other	N/A
Spec. No. (SFA)	A 5.9	AWS No. (Class)	ER 316L
Size of filler metals	∅ 1.6 mm. to ∅ 2.4 mm.	Brand name and type	Kobe or Equpvalent

POSITION (QW-405)

Position (s) of Groove	All Position
Welding Progression :	Uphill
Position (s) of Fillet	All

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range	N/A
Time Rang	N/A

PREHEAT (QW-406)

Preheat Temp. Min.	10° C
Interpass Temp. Max.	250° C
Preheat Maintenance	N/A

GAS (QW-408)

Shielding Gas (es)	99% Argon
Percent Composition (mixture)	Commercial Purity
Flow Rate	7-12 L/Min

PROCEDURE QUALIFICATION RECORD (PQR) 192.225

- PQR is a record of the welding data used to weld a test coupon for WPS Qualification.
  - PROCESS
  - PIPE AND FITTING MATERIALS
  - DIAMETERS AND WALL THICKNESS
  - JOINT DESIGN
  - FILLER METAL AND NUMBER OF WELD BEADS
  - ELECTRICAL CHARACTERISTICS
  - POSITION
  - DIRECTION OF WELDING
  - TIME BETWEEN PASSES
  - TYPE AND REMOVAL OF LINEUP CLAMP
  - CLEANING AND/OR GRINDING
  - PRE- AND POST-HEAT REQUIREMENTS
  - SPEED OF TRAVEL
  - DATE TESTED AND RESULTS

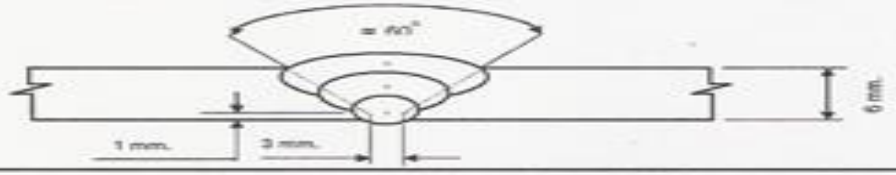
SR NDT & INSPECTION CO., LTD.
99/99 Moo.6 Fl.3 Phomtarawong Bldg. Srinakarin Rd., Nong-bon, Pravet Bangkok 10250
Tel : (662) 720-2166 (AUTO) Fax : (662) 720-2155

Procedure Qualification Record
ASME-QW-200.2,Section IX (WPQR)

RECORD OF WELDING (QW-483) PQR

Company Name :	Charoenchai Stainless Co., Ltd.	Project Name :	Fabrication Shop
PQR Record Number :	CS-PQR-01	Date :	30 January 2007
WPS Number :	CS-WPS-01		
Welding Process (es) :	GAS TUNGSTEN-ARC WELDING (GTAW)		
Type (Manual, Semi-auto or Automatic) :	Manual		

JOINT DESIGN (QW-402)



WELDING VARIABLES

BASE METALS (QW-403)

Material Spec.	SA- 240		
Type or Grade	Type 316 L To Type 316 L		
P No.	8	To P. No.	8
Thickness of Test Coupon	6.0 mm.		
Diameter of Test Coupon	8 Inch (plate)		
Others	N/A		

FILLER METALS (QW-404)

SFA Specification	A 5.9
AWS Classification	ER 316 L
Filler Metal F-No.	6
Weld Metal Analysis A-No.	8
Size of Filler Metal	∅ 2.0 mm.
Others	-
Weld Metal Thickness	6.0 mm.

POSITION (QW-405)

Position of Groove	2G
Progression of Welding (Uphill or Down)	Up Hill
Others	N/A

PREHEAT (QW-406)

Preheat Temperature	10° C
Interpass Temperature (max)	250° C
Others	N/A

POTWELD HEAT TREATMENT (QW-407)

Temperature	N/A
Hold Time	N/A
Others	N/A

GAS (QW-408)

Percent Composition

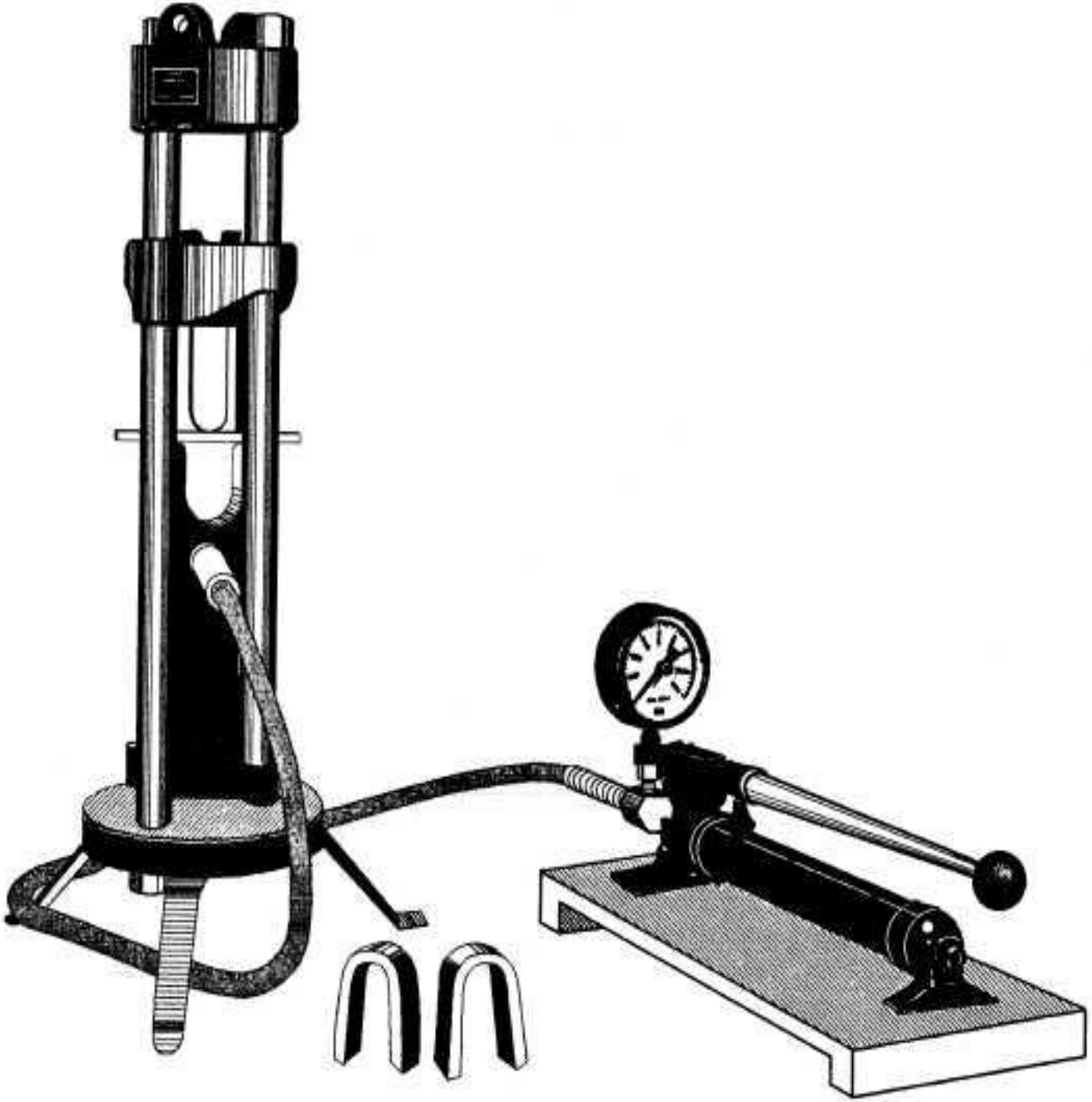
	Gas (es)	Mixture	Flow Rate
Shielding	Argon	Purity	7-12 L/Min
Trailing	-	-	-
Backing	-	-	-

ELECTRICAL CHARACTERISTICS (QW-409)

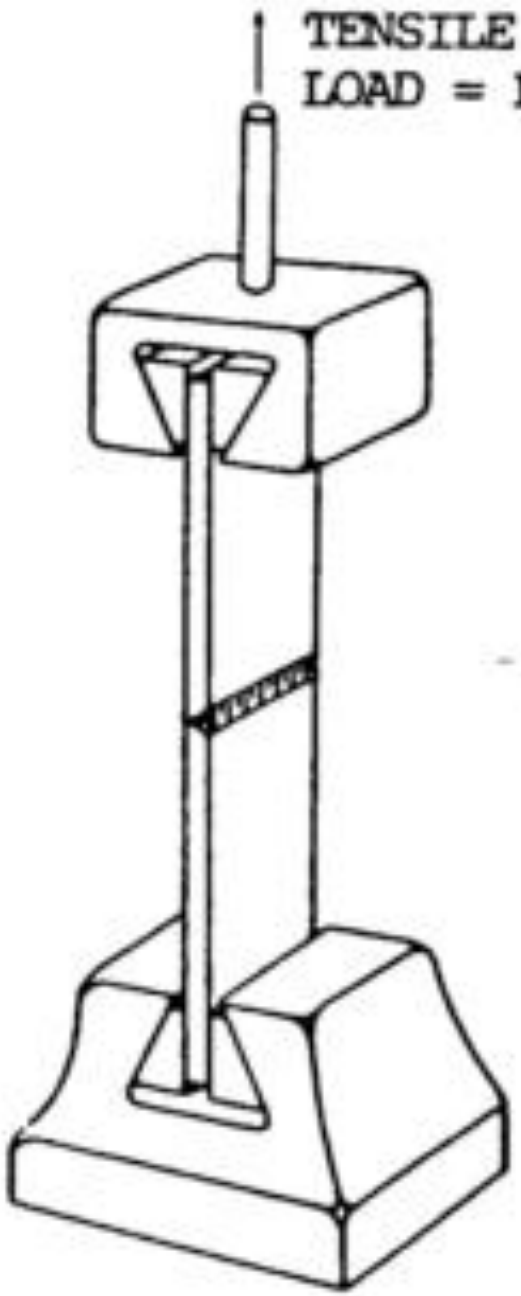
Current	DC		
Polarity	EN		
Amperage	See Page 3 of 3	Voltage	See Page 3 of 3
Tungsten Electrode Size	2.0 mm.		
Others	N/A		

TECHNIQUE (QW-410)

Travel Speed	5-10 Cm./Min.
String or Weave Bead	Both
Oscillation	N/A
Multipass or Single Pass	Single Pass
Multipass or Single Electrode	Single Electrode
Others	N/A




1-1
1-3



TENSION TEST
SPECIMEN

$$\text{AREA} = A = W \times T$$

$$\text{TENSILE STRENGTH} = \frac{\text{TENSILE LOAD}}{\text{AREA}} = \frac{L}{A}$$

Figure 13-6. Tensile strength test specimen and test method.

192.227 QUALIFICATION OF WELDERS

- WELDER MUST BE QUALIFIED IN ACCORDANCE WITH
  - API 1104 SECTION 6
  - ASME SECTION IX BOILER & VESSEL CODE

- EXCEPTION
  - PIPE OPERATING AT HOOP STRESS < 20% SMYS
  - SECTION I & II OF APPENDIX C SECTION 192
    - PIPE < 12” IN DIAMETER (4 ROOT BENDS)
    - SERVICE LINE CONNECTION (VISUAL & DESTRUCTIVE)

WELDER QUALIFICATION RECORD (WQR) 192.227

- WPS #
- Pipe Diameter & Thickness
- Type
- Weld Progression
- Summary of Qualification
- Welder's Name
- Date of Qualification
- Results
- Welding Process
- P#, F#, SFA#
- Position
- Specimen # and Types
- Current Used
- Welder's ID #
- Test Conducted By


4

192.229 LIMITATIONS ON WELDERS

- COMPRESSOR STATION PIPING
  - WELDERS QUALIFIED BY DESTRUCTIVE TESTING
- WELDING PROCESS (Used In Previous 6 Months)
  - WELD PERFORMANCE RECORD – WPR
- ONGOING QUALIFICATION STATUS > 20% SMYS
  - WELDS TESTED & FOUND ACCEPTABLE UNDER SECTIONS 6 OR 9 OF API 1104
    - AT LEAST TWICE A YEAR
    - INTERVALS NOT TO EXCEED 7-1/2 MONTHS
      - CAN ALSO BE USED FOR WELDS ON PIPE < 20% SMYS

WELD PERFORMANCE RECORD (WPR) 192.229

- WPR is a document that verifies a welder has performed a weld process.
- WPR should provide
  - Welder's Name
  - Welder ID #
  - Weld Process Used
  - Performance Date
  - Type of NDT Utilized

Yankeegas
The Northeast Utilities System

WELDER PERFORMANCE RECORD

LOCATION	SUPERVISOR	EXT.	DATE

WELDER'S NAME	Welder Id No.	PROCESS(ES)	LAST PERFORM DATE	WORK ORDER NO.

PROCESSES: SMAW, OXYFUEL

REVIEWED BY	TITLE	DATE
REVIEWED BY	TITLE	DATE
APPROVED BY	TITLE	DATE

ORIGINAL – SUPERVISOR WELD/FUSION

192.231 PROTECTION FROM WEATHER

- WEATHER CONDITIONS THAT COULD IMPAIR QUALITY OF COMPLETED WELD
  - RAIN
  - SNOW
  - STRONG WINDS
  - EXTREME COLD

192.233 MITER JOINTS

- PIPE TO BE OPERATED AT > 30% SMYS
  - MAXIMUM DEFLECTION OF 3 DEGREES
- PIPE TO BE OPERATED AT < 30% BUT > 10% SMYS
  - MAXIMUM DEFLECTION OF 12-1/2 DEGREES
  - MINIMUM ONE PIPE DIAMETER FROM ANOTHER MITER
- PIPE TO BE OPERATED AT $\leq$ 10% SMYS
  - MAXIMUM 90 DEGREES

192.225 PREPARATION FOR WELDING

- WELDING SURFACES MUST BE CLEAN
  - METHOD MUST BE SPECIFIED IN *WPS*
- PROPER ALIGNMENT METHODS
  - TO ENSURE FAVORABLE ROOT BEAD DEPOSIT
  - MUST BE MAINTAINED DURING ROOT BEAD DEPOSIT


RSB


JSP

192.241 INSPECTION AND TEST OF WELDS

- VISUAL INSPECTION BY QUALIFIED INDIVIDUAL TO ENSURE:
  - WELDING PERFORMED ACCORDING TO PROCEDURE
  - WELD IS ACCEPTABLE TO SECTION 9 API 1104
  - PIPE TO BE OPERATED AT ≥ 20% SMYS
    - NDT IN ACCORDANCE WITH 192.243
    - VISUALLY INSPECTED AND APPROVED BY QUALIFIED INSPECTOR IF:
      - PIPE DIAMETER < 6”
      - LIMITED # OF WELDS MAKES NDT IMPRACTICAL

WELD PROGRAM OVERVIEW

CONSTRUCTION


TEREX
CASE

WELD PROGRAM OVERVIEW

QUALITY CONTROL

192.243 NONDESTRUCTIVE TESTING

- ANY PROCESS THAT WILL CLEARLY INDICATE DEFECTS
  - PERFORMED IN ACCORDANCE WITH WRITTEN PROCEDURES
  - BY TRAINED & QUALIFIED INDIVIDUALS
  - PROCEDURES TO ENSURE PROPER INTERPETATION OF NDT

- NDT REQUIRED UNDER 192.241 (b)
  - WELDS SELECTED AT RANDOM
  - % REQUIRED EACH DAY
  - DETERMINED BY CLASS 1 – 4 LOCATION
    - CLASS 1 - 10%
    - CLASS 2 - 15%
    - CLASS 3 & 4 LOCATIONS - 100%
      - RIVERS, OFFSHORE, RAILROAD/PUBLIC HIGHWAY, TUNNELS, BRIDGES, AND OVERHEAD CROSSINGS
  - PIPELINE TIE-INS, INCLUDING REPLACEMENT SECTIONS
    - 100%

192.245 REPAIR OR REMOVAL OF DEFECTS

- WELDS UNACCEPTABLE TO SECTION 9 OF API 1104
  - MUST BE REMOVED OR REPAIRED
  - REMOVED IF CRACK > 8% OF WELD LENGTH
- REPAIR
  - DEFECT REMOVED DOWN TO SOUND METAL
  - MAY REQUIRE PREHEAT
  - MUST BE INSPECTED FOR ACCEPTABILITY
- REPAIR OF CRACK OR PREVIOUSLY REPAIRED AREA
  - REQUIRES QUALIFIED WRITTEN PROCEDURE

Codes & Standards Inspection Requirements

- American Welding Society (AWS)
- American Society of Mechanical Engineers (ASME)
  - Section IX
- American Petroleum Institute (API)
  - API 1104

QUALITY CONTROL PROGRAM

- Codes & Standards Inspection Requirements
- Welding Inspectors
- Types of Non-Destructive Testing (NDT)
- Documentation

WELDING INSPECTORS

- Provide Front Line Quality Control
- Should know applicable Codes & Standards
- Possess knowledge of NDT Inspection and Testing Techniques
- Must be capable of identifying welding discontinuities during Visual Inspection

American Welding Society

Certifies that Welding Inspector

Kristopher S Harris

has complied with the requirements of Section 6.1
of the AWS Standard for Qualification and
Certification of Welding Inspectors QC1-96

03071181

CERTIFICATE NUMBER

June 2003

VALID DATE

EMPLOYER: REFER TO WALLET CARD FOR
VALIDITY AND EXPIRATION DATE

AMERICAN WELDING SOCIETY INCORPORATED 1932 NEW YORK

PRESIDENT AWS

CHAIRMAN QUALIFICATION COMMITTEE

CHAIRMAN CERTIFICATION COMMITTEE


eCell

NON-DESTRUCTIVE TESTING (NDT)

- ***VISUAL INSPECTION***
  - LIMITED TO EXTERNAL SURFACE CONDITIONS
- ***LEAK TEST***
  - PRESSURE TEST
    - CHART RECORDING, GAUGE, SOAP TEST
- ***RADIOGRAPH (X-RAY)***
  - PERMANENT RECORD
  - DETECTS EXTERNAL/INTERNAL SURFACE WELD DISCONTINUITIES
    - CRACKS, POROSITY, SLAG, LP, IP, UNDERCUT, BURN THROUGH
- ULTRASONIC
  - PRIMARILY SURFACE DISCONTINUITIES
    - CRACKS, SLAG, LACK OF FUSION,
- MAGNETIC PARTICLE
  - SURFACE DISCONTINUITIES
    - CRACKS
- LIQUID PENETRANT
  - STRICTLY SURFACE DISCONTINUITIES

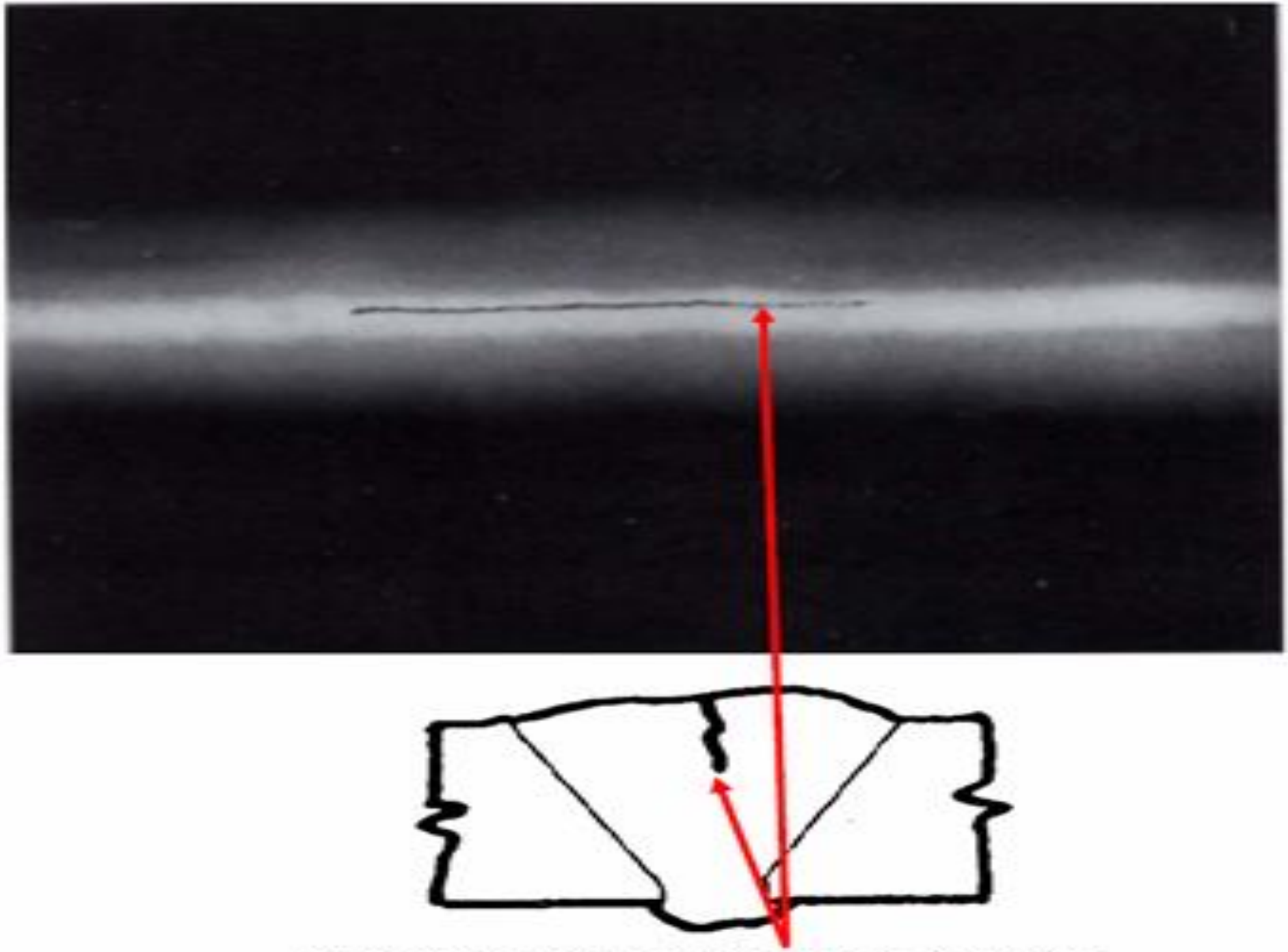

Adjustable Fillet Weld Gage
Stevensville, MI 49127
269-465-5750
THROAT SET
DECIMAL
3/4
5/8
1/2
3/8
1/4
1/8
1/32
Made in U.S.A.
Stainless
Patented

WELD PROGRAM OVERVIEW

RADIOGRAPH DEFECTS

SEE HANDOUT


CAUTION
RADIATION
AREA



FLAW TYPE: CENTER LINE CRACK - SURFACE

QUESTIONS

- Ed Easley
- 917-204-1939 Cell
- eeasley@danella.com

- THANK YOU

- ***ENJOY THE JOURNEY AHEAD THAT AWAITS YOU !***