Group Overview

SKC Management Group

SKC Engineering
- Welding Programs & Procedures
- Weld Engineering & Consulting
- Structural Connection Design & Steel Detailing
- Quality Assurance
- Fracture Mechanics & Fitness for Service
- Welding Simulation

SKC Inspection & NDT
- VT, MT, PT, UT, RT
- Advanced UT Methods – Phased Array & TOFD
- Quality Control for major projects -
  - Bridges
  - Hydro & Water Line
  - Marine
  - LNG
  - Mechanical Testing
SKC Engineering

- Founded by Steve Siu in 1997, SKC is BC’s premier provider of Welding Engineering & Related Services
- Retained by over 200 companies for their CSA Steel, Aluminum & Rebar programs
- Offices in Surrey & Victoria
- Active across Canada, the US & Asia
- Acquired by Applus RTD, Dec 2015

Steve Siu, B.A.Sc., P.Eng
IIW International Welding Engineer
CSA W178.2 Level III, AWS CWI
CSA W47.1, W47.2, W186 Retained Engineer
Welding Engineering/Consulting

• Technical support & instructions for new builds, refits & repairs
• Welding:
  – Welding Programs and Procedures
  – Testing
• Materials:
  – Materials selection
  – Quality assurance (Local & Overseas)
  – Failure analysis
• Advanced Solutions
  – Fracture Mechanics and Fitness For Service (FFS)
• Structural
  – Connection design & steel detailing
• Mechanical
  – Complex repair procedures
  – Cranes and hoists
  – Piping layout
Welding Programs & Procedures

• Our core business is administrating welding programs to:
  – CSA (W47.1 / W47.2 / W186)
  – AWS (D1.1 / D1.2 / D1.5 / D1.6)
  – ASME (Section IX)
  – International welding standards & classification society’s (Lloyds / DNV)

• Create welding procedures & welder qualification records

• Interact with regulatory bodies such as the CWB, BCSA, ABSA, Lloyds, ABS etc...

• Testing at your facility or at our welding lab with the latest Lincoln Power Wave units
• Welding simulation using VrWeld
  – Distortion
  – Residual stress
  – Microstructure

• Fracture mechanics & fitness for service calculations
  – levels 1, 2 and 3
    (API 579/ASME FFS-1, BS 7910)

• Crack propagation modeling and life time evaluations

Mahyar Asadi, Ph.D., P.Eng
Ph.D. in Welding Engineering specializing in welding simulation & modeling
Pipe butt weld

- Comparison of root crack in a steel pipe full penetration butt weld for aligned and mis-aligned pipes

- Pipe dimensions:
  - OD 40"
  - Wall thickness 3/32"

- Crack growth calculated for constant amplitude fatigue load cycling from 0 to 2 ksi

Aligned pipes

Mis-aligned pipes
- one pipe offset 3/32" horizontally and vertically

Initial elliptic crack:
  - 1/16" deep
  - 1/2" along inner surface

Pipe internal pressure: 0 to 2 ksi
Fracture Mechanics Simulation

Pipe elbow

- Initial crack located at root of a stiffener
- Displacement controlled cyclic load on the face of the flange
Repair a Cracked Drum
Welding Modeling and Simulation

Repair a Cracked Drum

Martensite Formation

Martensite Map
Repair a Cracked Drum – Microstructure Modeling

Bainite Map  Pearlite Map  Ferrite Map  Hardness Map
Weld Sequence Pattern:

How to perform **multi welds**
to get minimal distortion

One of the most difficult engineering tasks
Lab Work & Failure Analysis

• Full service mechanical testing lab certified to CSA W178.1
• Our lab offers the following services:
  – Tensile testing of samples
  – Charpy Impact Testing
  – Bend Testing
  – Macro and Micro Hardness Testing
  – Macro-etch
  – Metallurgical Microscopy
  – Positive Materials Identification

Sepehr Gerami, M.A.Sc., P.Eng
Typical Industries

• Ship building, ship repair and other marine
  – Seaspan, Allied, Zodiak, Babcock, Esquimault, FMFCB

• Pipeline & Penstock
  – Cloudworks, Tyson creek, Mayo B, Kokish, Thretheway

• Bridgework
  – Shell Sharkbite, Port Mann, Kicking Horse Canyon, St Patrick’s Bridge

• Structural Steel
  – Kelowna Hospital, York Theater, Spruce Creek Mine, Hamilton Transit

• Rides & Amusements
  – Disney Land Shanghai, Water slides, magic carpets, roller coasters

• Cranes & Lifting Devices
  – DP World Terminals, Falcon Equipment, Commercial Truck Equipment
NDT & Inspection

- SKC / Applus RTD combines SKC’s professional services with Applus’ international NDT experience
- Full service NDT offerings including:
  - VT, MT, PT, UT, RT, ET, HT, PMI
- Advanced services including PAUT, TOFD & digital radiography
- CGSB & SNT-TC-1a certified technicians
- CSA W178.1 certified with level III oversight
- QA review of NDT reports, procedures & film

James Allan
CGSB Level III, UT, PT, MT
PCN Phased Array UT (PAUT)
Approach to QA/QC

- Review Contract Requirements and Define project deliverables
- Identify required QA/QC activity and required qualification of individuals
- Risk Analysis: Cost Vs Impact
- Develop custom quality manual and ITP
- Transparent reporting to client
QA/QC Deliverables

- Sealed welding procedures
- Daily activity reports, DAR
- Monthly executive/progress reports
- Signed Inspection & Testing Plan
- Final report on all QC & QA,
- Turn Over Package on all QA activity including supporting documentation; MTR’s, NDT Reports, Inspection Reports etc.
# Inspection & Test Plan

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Activity</th>
<th>Control Item</th>
<th>Project or Industry Standard</th>
<th>Inspection or Test Frequency</th>
<th>Acceptance Criteria</th>
<th>Record Document</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Steel Selection / Receiving</td>
<td>Chemical and mechanical testing</td>
<td>API SL 44th Ed.</td>
<td>On material arrival for every heat</td>
<td>API SL 44th Ed.</td>
<td>Raw material incoming inspection report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Welding Procedure Specification (APPS issued)</td>
<td>ASME Boiler and Pressure Vessel Code - Section IB</td>
<td>Initial Set-up</td>
<td>API SL 44th Ed.</td>
<td>Weld procedure, welder &amp; procedure qualification report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repair Weld Procedure and welder qualification</td>
<td>API SL 44th Ed.</td>
<td>Every repair welder</td>
<td>API SL 44th Ed.</td>
<td>Welding pass MTC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Welding Consumables control</td>
<td>API SL 44th Ed.</td>
<td>Random throughout production</td>
<td>API SL 44th Ed.</td>
<td>Welding pass MTC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forming Control (Diameter, weld level, root gap etc.)</td>
<td>API SL 44th Ed.</td>
<td>Each pipe</td>
<td>API SL 44th Ed.</td>
<td>Weld procedure, visual &amp; dimensional inspection report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forming Control (Bell &amp; Spigot) exterior circumference, end,</td>
<td>API SL 44th Ed.</td>
<td>Each pipe as applicable</td>
<td>API SL 44th Ed.</td>
<td>Weld procedure, visual &amp; dimensional inspection report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>End scalping /grooving</td>
<td>100% UT</td>
<td>Each splice</td>
<td>API SL 44th Ed.</td>
<td>Weld procedure</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pipe Manufacturing</td>
<td>Visual Inspection</td>
<td>API SL 44th Ed.</td>
<td>QC 100% of all welds QA 20% every shift</td>
<td>API SL 44th Ed.</td>
<td>Visual inspection record</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>UT Testing</td>
<td>API SL 44th Ed.</td>
<td>QC 100% of each weld QA 50% each shift</td>
<td>API SL 44th Ed.</td>
<td>UT Test report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liquid Penetrant</td>
<td>API SL 44th Ed.</td>
<td>100% of each passhole weld</td>
<td>API SL 44th Ed.</td>
<td>PT Test report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>End Preparation &amp; Dimension</td>
<td>API SL 44th Ed.</td>
<td>Each pipe prior to coating</td>
<td>API SL 44th Ed.</td>
<td>Visual and dimensional inspection record</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weld documents</td>
<td>ASME B31.3 Cat M Fluid Service</td>
<td>Each pipe prior to coating</td>
<td>API SL 44th Ed.</td>
<td>No record provided</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finished pipe inspection</td>
<td>API SL 44th Ed.</td>
<td>Each pipe prior to coating</td>
<td>API SL 44th Ed.</td>
<td>Finished product inspection record</td>
<td></td>
</tr>
</tbody>
</table>

**Responsible Party Legend:**
- I: Impact
- W: Witness
- H: Hold (Cannot proceed to next manual step)
- D: Document
- T: Test
- V: Verify (Document review)
- B: Surveillance (Shop review)

**ITP Acceptance:**
- Initial
- Owner
- Contractor
- MTS
Summary

• For 18 years SKC has been delivering on its mission to provide the best possible service for our clients in the fields of Welding Engineering, Inspection & Non-destructive Testing

• Newly acquired by Applus RTD, expanding our geographic reach

• We have a diverse set of skill and talents in our field offering a perfect combination of advanced technical knowledge combined with practical welding experience

• We are a progressive and growth and are always looking to take on new challenges

• We look forward to working with you