Codes, Standards, Specifications & Promises – Why Details Matter in Steel Pole & Tower Fabrication!

What could possibly go wrong?

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MY GOAL FOR THIS PRESENTATION:

To reinforce why adherence to the **Codes, Standards, Specifications & Promises** of our industry is critically important in:

- **Designing,**
- **Constructing,**
- **and Maintaining**

reliable overhead line & station structures.
A transmission line is used to transport a product from its place of manufacture to the points of distribution. Before the recent advent of steel poles for EHV lines, lattice type towers composed of hot rolled members, were used successfully over a 70-yr period. They are the result of an evolutionary process, resulting in highly efficient and economical structures. Recently, the environmental pressure has created a public demand to go underground. Most of the technology to do this has not been developed and according to a recent article (1), the cost of converting $20 billion worth of overhead lines to underground transmission would approximate $150 billion. From a practical standpoint, underground transmission is not economically viable because interruptions of an underground line would
I hope you hear the message, **but please don’t shoot the messenger**!
Codes, Standards, Specifications & Promises –

Why Details Matter in Steel Pole & Tower Fabrication!

For most of us, design is invisible. Until it fails.
The **design and fabrication details** in the Poles and Towers we purchase are also mostly “invisible”!
We rely on:

**CODES**

**STANDARDS**

**SPECIFICATIONS**

**PROMISES**

To make sure we don’t have those problems:
CODES:

A collection of laws or regulations pertaining to a specific activity or subject.

- National Electric Safety Code
- Structural Welding Code
STANDARDS:

A industry consensus collection of “best practice requirements” pertaining to a specific activity or subject.

- ASCE Standards:
  (ASCE 48-11 Steel Pole Standard, ASCE 10-97 Tower Standard)

- AISC Standards
  (AISC 360-10 Standard Practices for Design & Fabrication)

- ASTM Standards
  (ASTM A6 ASTM A572, ASTM A123, etc.
  All material & galvanizing standards)

- IEEE Standards
**SPECIFICATIONS:**

A specific instruction of workmanship, materials, etc., required to be followed to achieve a required level of performance in our pole and tower products.

Each Utility generally issues a company specific specification or set of contract requirements with a purchase, and, these specifications generally reaffirm the Codes and Standards required to be followed in the fabrication of the product.
**PROMISES:**

A declaration or assurance that a supplier will do a particular thing or that a particular thing will happen if they are awarded an order for their product

- Promise of **capability**
- Promise of **qualification**
- Promise of **quality**
- Promise of **schedule**
So why do we continue to experience problems such as this?
Codes, Standards, Specifications & Promises –

Why Details Matter in Steel Pole & Tower Fabrication!

Or, this?
Or, this?
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WELD TOE CRACK
But, “This is the way we have always done it, . . . .”

From a Paper: “Powerline Tower Arm Failure Analysis”, Authored by Dr. Wayne Reitz, Ph.D., PE
Failures are caused by Human Errors

- **Errors of knowledge**
- **Errors of performance**
- **Errors of intent**

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1 Quoted From:
“A Re-Examination of Failure Analysis and Root Cause Determination”
M. Zamanzadeh, E. Larkin and D. Gibbon
Matco Associates
The same for “non-conformance” to Codes, Standards, Specifications, & Promises:

• Insufficient knowledge/Training of personnel
  *(Errors of Knowledge)*

• Low, or no quality performance expectations
  *(Errors of Performance)*

• Disregard/Disrespect for the requirements
  *(Errors of Intent)*
• **Errors of Knowledge:**

Hydrogen Embrittlement, or High Carbon Equivalency (CE), can lead to weld failure in HSLA steels if not properly understood;

or,

Taped top edge of applied barrier coatings may create a rigid “ledge” that may subsequently allow moisture to become trapped behind the coating and cause corrosion.
• **Errors of Performance:**

  Inadequate load calculations used in the design;

  or,

  Using incorrect welding procedure specification (WPS’s)

  or,

  Using the incorrect inspection standard;

  or,

  General poor quality workmanship during fabrication.
• **Errors of Intent:**

Shipping/releasing parts knowingly without required quality checks simply to meet production deadlines;

or,

Buying lower grade steel than that required of the design (or steel that may not meet CVNL requirements) simply to save on costs;

or,

Bypassing required minimum pre-heat requirements during welding of critical base plate to pole shaft welds simply to save time.
The “Hawthorne Effect”
(also referred to as the observer effect)

People tend to do a better job when they know they are being observed
“THE HOSTAGE EFFECT”

When materials purchased don’t meet the required Codes, Standards, Specifications and Promises, but schedules pressure you into accepting a non-conforming product, potentially reducing expected service life.
NOW WHO OWNS THE PROBLEM

of non-conforming product?
So Details Matter!
So what are the observable characteristics of a supplier that knows Details Matter?
15 General “Details Matter” Categories for a Comprehensive Quality Program
15 General “Details Matter” Categories

1. Project Contract/Agreement between the Owner and the Supplier:

• What is the form of the agreement

• What are the Codes, Standards, and Specifications the Supplier has been instructed to follow?

• HAVE ANY EXCEPTIONS BEEN TAKEN TO THE CODES, STANDARDS, AND SPECIFICATIONS, AND WERE THEY SPECIFICALLY EXCEPTED BY THE OWNER????
15 General “Details Matter” Categories

2. The Owner’s Specification:

• Does the Supplier have a thorough understanding of the owner’s specifications?

• Does the Supplier have a thorough understanding of other project requirements?
15 General “Details Matter” Categories

3. What is Supplier’s Quality Program:

• What does it cover?

• Does it work? / Is it being followed?
4. **The Supplier’s Team on the Shop Floor:**

- Who are they?
- Do they appear knowledgeable?
- Are they cooperative when asked questions?
5. **The Fabrication Drawings:**

- How are the drawings controlled?
- Do the drawings appear complete?
- How are changes to the drawings handled?

15 General **“Details Matter”** Categories
6. **Fabrication Work Instructions:**

- Are proper WI’s prepared for the various tasks involved in
- Are the WI’s available to shop employees?
- Are employees trained in the WI’s?
15 General “Details Matter” Categories

7. Cutting, Burning, & Welding:

- Are the requirements of AISC, and AWS being followed?
15 General “Details Matter” Categories

- Code Compliance
- Workmanship Control
- Documentation Control
DOES THE FIT-UP MEET TOLERANCES?
THE RESULT OF POOR FIT-UP!

Outside (Crack)  Inside (Out of tolerance)
Weld Procedure Specification (WPS):

How you plan to weld the joint.
Procedure Qualification Record (PQR): How you actually welded this joint.

Would include the test results:
- Tensile tests
- Root Bend Test
- CVNL Tests
Welder Qualifications?

- Flat
- Horizontal
- Vertical
- Overhead

Increasing difficulty
15 General “Details Matter” Categories

8. **Equipment:**

- Does the Supplier have the equipment they need to properly do the job?
15 General “Details Matter” Categories

9. Safety & Housekeeping:

Does the Supplier have an adequate Safety Program in place?
10. Inspection & Test Equipment:

- What testing is being done?
- Is the equipment for the testing properly certified and calibrated?
- Are those doing the testing properly certified?
11. Material Control:

- How is incoming material received and inspected for conformity to the specifications?
- How is material issued and controlled throughout the shop?
- Is there traceability?
12. Suppliers’ QA/QC Activities:

- How are project specific requirements incorporated into the suppliers fabrication process?

- Is there a process/program in place to ensure subcontractor quality adherence to the required Codes, Standards, Specs.
15 General “Details Matter” Categories

13. Galvanizing Requirements:

- What does the supplier require of the Galvanizer?
- How is post galvanizing UT for “toe cracks” accomplished?
- How are any special galvanizing requirements communicated?
- Are conformance to specification “certifications” requested?
14. Other Finishing (Blasting/Coatings):

- Are work instructions/procedures in place?
- Are coating materials (paints, etc.) being properly stored?
- How are Customer specific requirements communicated?
- Is verification inspection being done?
15 General “Details Matter” Categories

15. Shipping and Logistics Requirements:

- How are any special shipping requirements communicated?
- Does it appear there are suitable “loading plans” for the safe and efficient loading/unloading of trucks?
Develop a checklist of general requirements covering those 15 categories:

Quality Audit Checklist
General Requirements

Last Modified: September 27, 2013

This Quality Audit Checklist / General Requirements Checklist is a work product belonging to ReliaPOLE Inspection Services Company, LLC. (RISC). As such, it is to be considered and treated as confidential information and is not to be reproduced or otherwise disclosed to others without the express written permission of ReliaPOLE Inspection Services Company, LLC.
“IF YOU CAN’T MEASURE IT, YOU CAN’T MANAGE IT”

PETER DRUCKER
Actionable Data: Scoring for each of the 15 Categories
**Actionable Data: Develop an overall score**

<table>
<thead>
<tr>
<th>Section</th>
<th>Item</th>
<th>Rating</th>
<th>Weight</th>
<th>Score</th>
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<tr>
<td>1</td>
<td>Project Contract/Agreement w/ Owner</td>
<td>90</td>
<td>5%</td>
<td>4.5</td>
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<tr>
<td>2</td>
<td>Organization's Quality Manual</td>
<td>85</td>
<td>2%</td>
<td>1.7</td>
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<tr>
<td>3</td>
<td>Contact &amp; Biographical Info</td>
<td>90</td>
<td>1%</td>
<td>0.9</td>
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<tr>
<td>4</td>
<td>Customer Specifications/Requirements</td>
<td>65</td>
<td>5%</td>
<td>3.25</td>
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<td>5</td>
<td>Fabrication Drawings</td>
<td>70</td>
<td>8%</td>
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<tr>
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<td>Safety/Housekeeping</td>
<td>90</td>
<td>2%</td>
<td>1.8</td>
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<td>7</td>
<td>Fabrication</td>
<td>80</td>
<td>15%</td>
<td>12</td>
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<tr>
<td>8</td>
<td>Welding</td>
<td>75</td>
<td>15%</td>
<td>11.25</td>
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<td>Equipment</td>
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<td>3%</td>
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<td>10</td>
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<td>5%</td>
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<td>11</td>
<td>Material Control</td>
<td>60</td>
<td>10%</td>
<td>6</td>
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<tr>
<td>12</td>
<td>QC Inspections and Tolerances</td>
<td>55</td>
<td>15%</td>
<td>8.25</td>
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<td>13</td>
<td>Galvanizing Facilities</td>
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<td>5%</td>
<td>4.75</td>
</tr>
<tr>
<td>14</td>
<td>Other Coatings/Blasting Cleaning Facilities</td>
<td>100</td>
<td>5%</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Shipping &amp; Logistics</td>
<td>95</td>
<td>4%</td>
<td>3.8</td>
</tr>
</tbody>
</table>

**Total:** 100.00%  **Overall Score:** 75.55

From these scorecards, analytical trends can be determined over time.
What about:
“We only buy from a ‘trusted’ manufacturer”?
“Trust, but Verify!”
The most prevalent Non-Conformances we typically find:

1. Joint gaps too large during fitup
2. Improper preheat being used
3. Improperly qualified WPS’s
4. Welding out of position
5. Welding out of WPS parameters
6. No repair procedures for fixing non-conforming product
7. Lack of traceability
8. Poor knowledge/training of NDT Techs
9. Lack of understanding of “Special Requirements”
10. MTR’s not being reviewed properly for conformance
11. Quality “Escapes” – Green Tagged product with conformance issues
To Summarize: Details Matter!

Pay Attention to the Codes, Standards, Specifications & Promises
Questions?

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