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# Welding Engineers NEWSLETTER

Fall 2021

We are pleased to present the second CWB Welding Engineers Newsletter. In this edition you will find the latest news about CWB procedures and welding consumables certification department, updates on the new welding standards, and information on the upcoming forum.

## IN THIS EDITION YOU WILL FIND:

- ▶ CWB procedures department year-in-review (April 2020 to March 2021).
- ▶ Notch-toughness capability of welded joints
- ▶ Bending of aluminum specimens as per CSA W47.2
- ▶ Fillet weld tests for the certification of welding consumables
- ▶ Upcoming welding engineer forum...



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## ► CWB PROCEDURE DEPARTMENT YEAR IN REVIEW (April 2020 to March 2021):

In the first newsletter published in the Fall 2020, we explained how the CWB procedure department operates. In this edition we will summarize the performance of the department during the last fiscal year (from April 2020 to March 2021). Over that twelve-month period the procedure department received a total of 12,689 submissions (number of emails received by the department relating to welding procedures), the average number of working days between the reception and our review/response to the submissions was under 1.5 days. It worth to mention that to process those 12,689 submissions we had to review over 37,000 welding procedure data sheets (WPDS) and 2,800 procedure qualification reports (PQR).

CWB Procedure Department April 2020 to March 2021	
Total received during FY21	12,689
Average respond time (days)	1.46
# of WPDS reviewed	37,266
# of PQR synchronized	2,803

## ► NOTCH-TOUGHNESS CAPABILITY OF A WELDED JOINT

For welded structures exposed to the extreme Canadian weather, it is critical to ensure the base metal and the welded zone have the capability to maintain the integrity it was designed for. The characteristic of a steel and weld to keep its strength/ductility at low-temperature is called notch-toughness. It is the capacity of the steel/weld to limit the propagation of a crack at low-temperature and it can be quantified with an impact energy level at specific temperature, e.g., 27J @ -45°C. Steels used in such conditions are selected for their notch-toughness at low-temperatures. We can recognize these grades that are designated with the letter "T" in CSA Standard G40.21, e.g., grade 350WT. In other specifications such as ASTM, toughness properties of the steel are not necessarily specified in the grade. Further investigations could be required to ensure the steel has been tested for toughness at the specified low temperature. Most welding consumables are also tested for notch-toughness during certification tests, as it is required by CSA W48, AWS A5 specification and ISO standards for welding consumables. It is important to mention that not all classifications require impact testing of the welding consumables. Again, further verifications are required to ensure the selected welding consumable have been tested for toughness.

For welded joints, when notch-toughness base metal grades and corresponding welding consumables with notch-toughness capabilities are specified on welding procedures, it ensures that under normal conditions the resulting weld zone should also have the same notch-toughness capability. But as the heat input, preheat, inter-pass temperatures and PWHT will have a significant impact on the notch-toughness of the welded zone, additional demonstration of the notch-toughness of the weld metal and the heat affected zone could be required through special procedure testing. Annex E of CSA W47.1 includes requirements (essential variables and testing) specific for notch-toughness (also called impact tests).



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## ► NOTCH-TOUGHNESS CAPABILITY OF A WELDED JOINT (continued)

When a welding procedure specifies base metal grades and welding consumable classification with adequate notch-toughness and supporting procedure qualification test records with impact test done in accordance with annex E of CSA W47.1 or other contract specific/ governing code or standard, it will ensure, when the accepted welding procedure is followed, the welded joint will demonstrate the proven notch-toughness capacity it was designed for.

## ► BENDING OF ALUMINUM SPECIMENS AS PER CSA W47.2

Bend tests for aluminum is not straightforward as it is for steel. Bending of steel specimens can be done using plunger or wraparound type jigs and the mandrel or plunger dimension depend solely on the yield strength of the steel. The heat-affected zones of weld in aluminum alloy are significantly softer and weaker than the surrounding material (particularly in heat-treatable alloy). If aluminum weld specimens are bent using a plunger type jig, the softer heat-affected zone will normally take all the deformation and bend sharply and break without being able to complete an adequate bend. For that reason, CSA W47.2 requires aluminum welded specimens to be bent using a wraparound type jig, so that the bend specimens achieve the same radius of curvature and withstand uniform strain level.

For ER1XXX and ER5XXX filler alloys, the bend tests jig mandrel radius depends on the aluminum alloy, filler alloy and specimen thickness used, refer to Figure 18 of CSA W47.2. As the bends are done on the as-welded specimen (no annealing), CSA W47.2 requires bend test specimens of any aluminum alloy welded with ER4XXX filler metal that the test specimen thickness shall be reduced to 3 mm prior to bending and then bent over a 50 mm diameter mandrel. It is important to be aware of these special testing conditions for aluminum to avoid inadvertent failure of test specimens.

## ► FILLET WELD TESTS FOR THE CERTIFICATION OF WELDING CONSUMABLES

It is practical for a CSA W47.1 certified company to select joints described as prequalified for projects referencing CSA W59 standard. In addition to the joint geometry, and other limiting factors, a welding consumable with the appropriate positional designator must be used to deem the electrode certified for use with that particular joint. Specifically, for FCAW and MCAW welding consumables, a '1' positional designator in the classification can be used for welding of groove welds and fillet welds in any position, while a '0' positional designator will limit certification status of the consumable to flat groove welds and flat and horizontal fillets (for SMAW process '0' is replaced by '2').

Welding consumable manufacturers for SMAW (carbon and low-alloy steel) or FCAW (carbon, low-alloy and stainless steel) or MCAW (carbon, some low-alloy classifications) conduct specific tests during the CWB certification process to prove that a consumable can produce acceptable welds for the '1' or '0' designator.



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## ► FILLET WELD TESTS FOR THE CERTIFICATION OF WELDING CONSUMABLES (continued)

To establish a positional designator, fillets must be welded in vertical and overhead positions for '1' designator and horizontal position for '0' and evaluated by CWB based on specific criteria, depending on process and base material. For all processes a visual inspection of the welds is required. For SMAW carbon and low alloy, FCAW/MCAW carbon and low alloy consumables the fracture at the root of the joint is verified for penetration; in addition, for all processes, a transverse section of the weld is macro etched and the size of the weld legs is measured along with incremental measurements of the convexity and leg difference.

Some of the welding consumables listed on the CWB site are shown with old classifications in brackets and show '2' instead of '0', for instance, E490T1-M21A3-CS1-H8 (E492T-9M-H8). These classifications are still displayed to assist the reviewer of the already approved WPDS in connection with the consumables labeled with the new open classifications.

## ► WELDING ENGINEER FORUM:

On July 13 and 14, we had over 60 welding engineers attending our second welding engineer forum. During the forum, some of the topics discussed were ranging from unlisted base metal, PQT limitations, WeldEye, PQT from other organizations, sharing welding procedure between fabricators and Q&A session, For further information, please visit the welding engineer webpage at :

<https://www.cwbgroup.org/certification-and-qualification/welding-engineers>

For the next forum, which should be held at the end of November, the format will be modified. We are considering forming several small groups to promote discussions, we will keep you informed.

*Thank you*

CWB Procedures & Electrodes Certification Team