Steel Interchange

Steel Interchange is an open forum for *Modern Steel Construction* readers to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine. If you have a question or problem that your fellow readers might help you to solve, please forward it to *Modern Steel Construction*. At the same time, feel free to respond to any of the questions that you have read here. Please send them to:

Steel Interchange
Modern Steel Construction
One East Wacker Dr., Suite 3100
Chicago, IL 60601-2001

Answers and/or questions should be typewritten and double-spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a Wordperfect file or in ASCII format).

The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. and have not been reviewed. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principals to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 312/670-2400 ext. 433.

The following responses from questions in previous Steel Interchange columns have been received:

When welding a steel that has dual certification (A36 and A572 Gr 50), is there a low hydrogen electrode requirement?

The following is a synopsis of an extensive welding study Chaparral Steel had performed on Dual Certified Steel.

In essence, multi-cert steel is an ASTM A572 grade 50 steel that, through stringent manufacturing controls, also conforms to the chemical and physical requirements of ASTM A36.

The extensive welding tests we conducted conclude that the Vanadium or Columbium/Niobium alloy additions do not adversely effect the A36 welding procedures. In other words if the multi-cert steel is to be used in an A36 application, the usual A36 welding procedures are applicable and A572 Grade 50 procedures are applicable if the steel is to be used in an A572 Grade 50 application.

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A test program was conducted at the request of Chaparral Steel in order to compare the weldabilities of A36/A572 Gr 50 dual grade steel and of A36 steel. Both steels are structural steels that are produced by Chaparral Steel in Midlothian, Texas. A36 steel is familiar throughout the industry. A36/A572 Gr 50 is a steel formulated to meet the overlapping chemical and mechanical specifications for both ASTM A36 and A572 Grade 50 steels. This "dual grade" capability was achieved by careful selection and control of steel chemistry.

The intent of this program was to demonstrate whether or not these two somewhat different steel products could be welded using identical welding procedures. The information to be generated in the test program was intended to develop a data base of weld test results to enable responses to questions concerning weldability and, moreover, the applicability of existing welding procedures to this dual grade steel. There was concern in the field as to procedures to the dual grade steel. There was concern in the field as to whether a steel with ostensibly higher properties would need different welding procedures from A36 steel. Also, the program would provide information to help field personnel convince welding inspectors that a particular welding procedure could be applied to a dual grade steel and to A36.

Welds were made in "thin" flanges and in "thick" flanges using welding processes commonly employed in the steel fabrication industry. GMAW, SMAW, FCAW and SAW processes were chosen for testing. Exactly the same welding consumables and welding parameters were used on the A36/A572 Gr 50 dual grade steel as on A36 steel. Actually, the welders were not aware that two different steels were being welded in the program. Consumables for each process were chosen that are proper for either A36 or for A572 Gr 50 steel. Tests were conducted in accordance with the weld qualification requirements and procedures of AWS D1.1 (1992) as a minimum.

Details of the test procedures and test results are presented in a separate test report. Conclusions from these data are presented below:

Weldability of the two steels is the same. Welds on the two steels (A36 and A36/A572 Gr 50 dual grade) using identical electrodes, fluxes, and welding parameters produced acceptable, equivalent welded joints. Welds were made utilizing SMAW, GMAW, FCAW, and SAW techniques and equipment. No difference in the welding process on the two steels was encountered by the welders. For weldability purposes, the two steels are interchangeable.

The weld program produced no weld cracking. Radiographic inspection revealed only isolated areas of light porosity. All bend specimens were acceptable. Tensile specimens all fractured in the base metal rather than in the weld or in the heat affected zone. Charpy impact tests at temperatures ranging from -20 F to 75 F showed no difference in behavior for welds in thin flanges. Welds in thick *flanges exhibited slightly lower impact properties* for dual grade steel than for A36 steel over the range of temperatures. Rockwell hardness readings revealed no harmful hard zones in any of the welds. Based on these data, it is appropriate for the user to utilize his usual welding procedure for the specified steel when welding A36/A572 Gr 50 steel.

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Another response:

The following is in reply to the two questions regarding welding:

1. When welding a steel that has dual certification (A36 and A572 Gr. 50), is there a low hydrogen electrode requirement?

Table 4.1 of AWS D1.1 gives the requirements for filler metal/base metal combinations for *prequalified* welding procedures (WPS's). ASTM A36 is listed in Group I and A572 Gr. 50 in Group II. If one steel meets all the requirements for both materials classifications, it is reasonable to require the WPS's to meet all the requirements that would be applied to welding on either material. In the particular example, this would preclude the use of non-low hydrogen electrodes on this particular steel However, I do not believe this issue has been formally addressed the by D1 Committee.

WPS's maybe qualified by test. This approach could be used to permit the use of the same electrodes permitted to be used on A36 to be applied to A572 Gr. 50. It should be noted, however, that the tests used by D1.1 for WPS Qualification do not duplicate the restraint commonly associated with actual fabrication.

2. Is AWS D1.1 Table 4.1, Note 1, regarding joints involving base metals from different groups, applicable to this condition?

No. The purpose of this footnote is to address filler metal requirements for joints that involve two separate base metal groups. The strength of the filler metals employed need only match the requirements for the lower strength steel, although the filler metal must in all circumstances be low hydrogen.

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Serviceability is a particular concern for crane systems in industrial buildings but is not clearly covered in the standard literature. What are deflection limits for crane runway systems?

The design and installation of cranes is governed by the Crane Manufacturers Association of America's (CMAA) Specification #70, Specifications for Electric Overhead Traveling Cranes. Section 1.4.3 of this document states, in part:

"The lateral deflection (of the crane runway) should not exceed L/400 based on 10 percent of maximum wheel load(s) without impact. The vertical deflection should not exceed L/600 based on maximum wheel load(s) without impact. Gantry and other types of special cranes may require additional considerations."

In the absence of local building code requirements that are more stringent, the designer of an overhead crane installation should follow the CMAA requirements.

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New Questions

Listed below are questions that we would like the readers to answer or discuss.

If you have an answer or suggestion please send it to the Steel Interchange Editor, Modern Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

Questions and responses will be printed in future editions of Steel Interchange. Also, if you have a question or problem that readers might help solve, send these to the Steel Interchange Editor.

What are tolerances for cambered members? When is it proper to cold camber or curve a member and when is it necessary to use heat?

When erecting steel beams on a brick wall, could the non-shrink gourt be omitted under a proper bearing plate, if the surface of the brick is smooth, clean of any and all debris and leveled?

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