

The engineer's responsibility in the production of ASTM A184 welded deformed steel bar mats

Welded wire reinforcement produced in accordance with ASTM A1064 and welded deformed steel bar mats conforming to ASTM A184 are two different reinforcement products. This blog discusses some of these differences.

Starting off with a simple comparison table:

	Welded Wire Reinforcement	Welded Deformed Steel Bar Mats
Governing Material and Manufacturing Specification	ASTM A1064-18a	ASTM A184-19
Constituent material	ASTM A1064 deformed or plain wires (up to 80 ksi)	ASTM A615 deformed steel bars (40 ksi or 60 ksi) ASTM A706 deformed steel bars (60 ksi)
Acceptance in Structural Design (ACI 318-19)	Table 20.2.2.4(a): extensive applications directly referenced	Table 20.2.2.4(a): limited applications directly referenced
Welding Type Used	Machine-controlled electric resistance welding per ASTM A1064	Manual welding per AWS D1.4
Responsibility for Definition of welding qualification	ASTM A1064 implicit	By Engineer-of-Record definition or delegation
Representative organization	The Wire Reinforcement Institute	<i>For loose steel bars prior to welding:</i> Concrete Reinforcing Steel Institute <i>For welded bar mats:</i> None

Both WWR and welded deformed steel bar mats are acknowledged as mild steel reinforcement for concrete structures in ACI 318, though there are significant restrictions on permitted structural usage of ASTM A184 mats in contrast to ASTM A1064 WWR. Table 20.2.2.4(a) in ACI 318-19 is an excellent resource for this information.

Perhaps the most noteworthy attribute of ASTM A184 mats is the manner in which they are to be assembled. ASTM A184 dictates that welding be performed in accordance with AWS D1.4 "Structural Welding Code – Steel Reinforcing Bars". Interestingly enough, AWS D1.4 (2018) states the following:

Section 6.2.3 Cross Welding Bars. *Welding of bars that cross shall not be permitted unless authorized by the Engineer.*

At first this seems like a direct contradiction. ASTM A184 defines the requirements for a manually-welded rebar mat inherently comprised of crossing joints but invokes a standard in AWS D1.4 wherein such a welded joint is, by default, prohibited. Upon closer review, however, AWS D1.4 does include the caveat “*unless authorized by the Engineer*”. Because of this, it is important for the design professional of record to recognize the following:

If a structural design is to rely on ASTM A184 welded mats, then the manual welding process itself, a function of workmanship, technique, welded joint size/geometry, etc., is largely the responsibility of the design professional to either define directly or to delegate.

This is in contrast to WWR produced in accordance with the ASTM A1064, where the designer simply specifies WWR as a structural reinforcement without bearing any responsibility for definition of the manufacturing process.

ASTM A184 does establish the metrics for acceptance of the resulting manually-welded material by mandating that the strength and elongation of a welded specimen – when tested across a point of weld - must conform to the strength and elongation requirements established in the specifications for the reinforcing bars themselves. Because authorization of the welding is at the discretion of the individual engineer, however, some ambiguity and variation may arise related to how quality control of the welding process is actually being maintained on the front end in order to produce welded product that consistently and reliably satisfies the test requirement. Put plainly, bar mats intended to conform to ASTM A184 on one project may actually be produced to a different level of stringency on another, all because the respective projects have different design professionals.

In the end it stands to reason that welding personnel and processes used in the production of manually-welded deformed steel bar mats should be shaped by a qualification process not unlike that referenced in Clause 8 of AWS D1.4, whereby a Procedure Qualification Record (PQR) and Welding Procedure Specification (WPS) are established to ensure repeatability and conforming quality of the welded joints. Yet AWS D1.4, cited directly by ASTM A184, effectively defers decisions regarding such control to the individual engineer. It is important for design professionals to understand the role they are expected to play whenever ASTM A184 bar mats are specified for use on a project.

Author’s note: there are some instances in the WWR industry where WWR machine-welded mats are conversationally abbreviated using the term “bar mats”. This simplistic nomenclature should not be confused with that associated with ASTM A184 manually welded deformed steel rebar mats.

For more information on WWR, refer to ACI 318, AASHTO LRFD Bridge Design Specifications, and AREMA Manual for Railway Engineering, in conjunction with WRI resources found at www.wirereinforcementinstitute.org.