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Grade 70 vs. Grade 80 Chain for Extrication/Rescue

There are two issues being discussed on this forum which are separate but related: “Overhead Lifting” and chain grade. Unfortunately I think that there is quite a bit of misinformation here, and I’d like to see if some documentation and actual expert opinions can clear up these issues.

“Overhead Lifting”: This is a Federal OSHA and Department of Labor legal term applied to equipment and personnel involved in lifting loads primarily in construction and manufacturing environments. It does not and cannot apply to the fire service except in cases where we bring in a certified overhead lift outside agency (such as a commercial crane) to assist us. Per OSHA 1910.179, 1910.184, 29 CFR 1926.1401, 1926.1404, 1926.1425 and several other standards, not only does each component of the overhead lifting system have to meet an overhead lifting standard but each person involved must have documented overhead lifting training. Not only do the vast majority of Firefighters not have this training, but none of our equipment is manufactured to these standards. If you wanted to do an “overhead lift” you could not use lift (air) bags, hydraulic tools, struts, cribbing, winches (including those on a tow truck), come-alongs, Hi-Lift jacks, etc. Emergency responders are exempt from these OSHA requirements for extrication/rescue as well as other OSHA requirements because it would be impossible for us to comply. To my knowledge the only areas we are required to comply with OSHA standards are in Confined Space and Trench rescue. Mask fit testing also falls into this category. So the answer to the question “do we do overhead lifting in extrication” is No.

Chain: Obviously this is a controversial and highly discussed topic here. We have had many “experts” weigh in with different opinions. To clarify things I brought this topic to REAL experts: Engineers from the two largest chain manufacturers in the US. I called Peter Hogan, Senior QA Engineer with the Columbus McKinnon Corporation, and David Boyle, Rigging Engineer with the Crosby Corporation chain division. I spoke to both of these gentlemen at length discussing our job as rescuers, environments and the details of the discussions on chain grade on this and other discussion boards. Both were in complete agreement that Grade 80 and 100 chains absolutely should NOT be used in extrication. The correct grade to use is Grade 70.

Here is why; Grade 80/100 chain (and Grade 120) chains are made from heat treated alloy steel. This makes a strong chain with good stretch characteristics. These chains are specifically made for “Overhead Lifting” as discussed above. Unfortunately they are very delicate due to the fact that they cannot be galvanized or coated with anything else except a light coat of paint. This paint is intended to stop flash rust and to protect the chains somewhat from moisture. However, this paint does little to protect the chain from harsh environments. They fail the salt water spray test (for example) in a matter of hours. Because of this there are strict regulations for Grade 80/100 chains. ASME B30.9-9.1 sets the mandatory guidelines for these chains. They are required to have an ID tag permanently affixed. They are required to be inspected annually (or more often) by a trained chain inspector. A written log must be kept for each chain. Each link must be inspected and measured with a Caliper. If wear, nicks, or stretch reduce the diameter of any part of a link more than 0.052” (for 3/8” chain), the chain must be removed from service. You must not drag them on the ground, let them come in contact with sharp objects, pull them out from under a load, etc.While all of those requirements would be difficult for us to comply with, there is one factor which absolutely eliminates the use of Grade 80/100 chains from extrication: battery acid. Because these chains cannot be galvanized (or Chromated, etc), they have no protection against battery acid.

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This is a problem in two ways. First, the acid will obviously cause corrosion and pitting of the steel. These chains are also slightly porous from heat treating which allows some acid to soak in and cause damage below the surface of the chain. But the hidden killer is Hydrogen embrittlement. When exposed to acids the alloy steel rapidly undergoes a chemical process called Hydrogen embrittlement which caused the steel to become very brittle and to lose its ability to stretch and support weight. It is undetectable by inspection. What happens is that the embrittled chain will catastrophically fracture without warning at a load significantly less that rated load.

Both engineers stated that a Grade 80/100 chain exposed to battery acid must be removed from service. Mr. Boyle said this was what they call a “one and done” event i.e. one exposure and the chain is done. In fact the Crosby Grade 80/100 chain inspection sheet states “If it is suspected that the chain has been exposed to a chemically active environment, remove it from service”. Nothing can be done to the chain because Galvanizing or plating also causes Hydrogen Embrittlement.

Both engineers stated that Grade 70 chain is the correct choice for extrication. Grade 70 chain is called “Transport” chain. It is made of heat treated Carbon steel. It is still incredibly strong, and the lack of the special alloys both produces a more closed surface porosity as well as removing the high susceptibility to Hydrogen embrittlement. Grade 70 chains are galvanized, Zinc Chromated or treated with some other corrosion resisting sacrificial anode material. They survive the salt spray test for many days (instead of hours for 80/100). They are MUCH tougher than the 80/100 chains. They resist battery acid extremely well due to their sacrificial anode coating as well as their resistance to Hydrogen embrittlement.

What’s the strength difference between Grade 70 and 80? 3/8” Grade 70 has a working load of 6,600 Lbs with a 4:1 safety factor. 3/8” Grade 80 has a working load of 7,100 Lbs with a 4:1 safety factor. Yep, just a 7% gain in strength going from Grade 70 to 80.

So who should carry Grade 80/100? The FEMA teams. They spec Grade 80 chain because they DO have to work with the commercial cranes that they bring in for collapse. However, the FEMA guys know the chain requirements and comply with the OSHA requirements. Unfortunately some of us have looked at the fact that the FEMA spec is for Grade 80 chain and thought it should apply to extrication as well. As discussed above, this is absolutely untrue and is in fact dangerous.

Sorry for the long post, but I thought this information is important to hopefully prevent some bad things from happening if those Grade 80/100 chains break when you least expect it.

Regards,

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Written by Tim O’Connell for Firehouse.com Forums on 4/22/2011
http://www.firehouse.com/forums/t120651/