

SSAB



*A stronger,
lighter and more
sustainable world*

DOCOL[®]
THE AUTOMOTIVE STEEL



SSAB

Docol R8 Tube – EXCEPTIONAL SPEED
REQUIRES EXCEPTIONAL SAFETY

ABOUT SSAB

LEADING PRODUCER OF
ADVANCED HIGH-STRENGTH
STEELS FOR OVER 40 YEARS



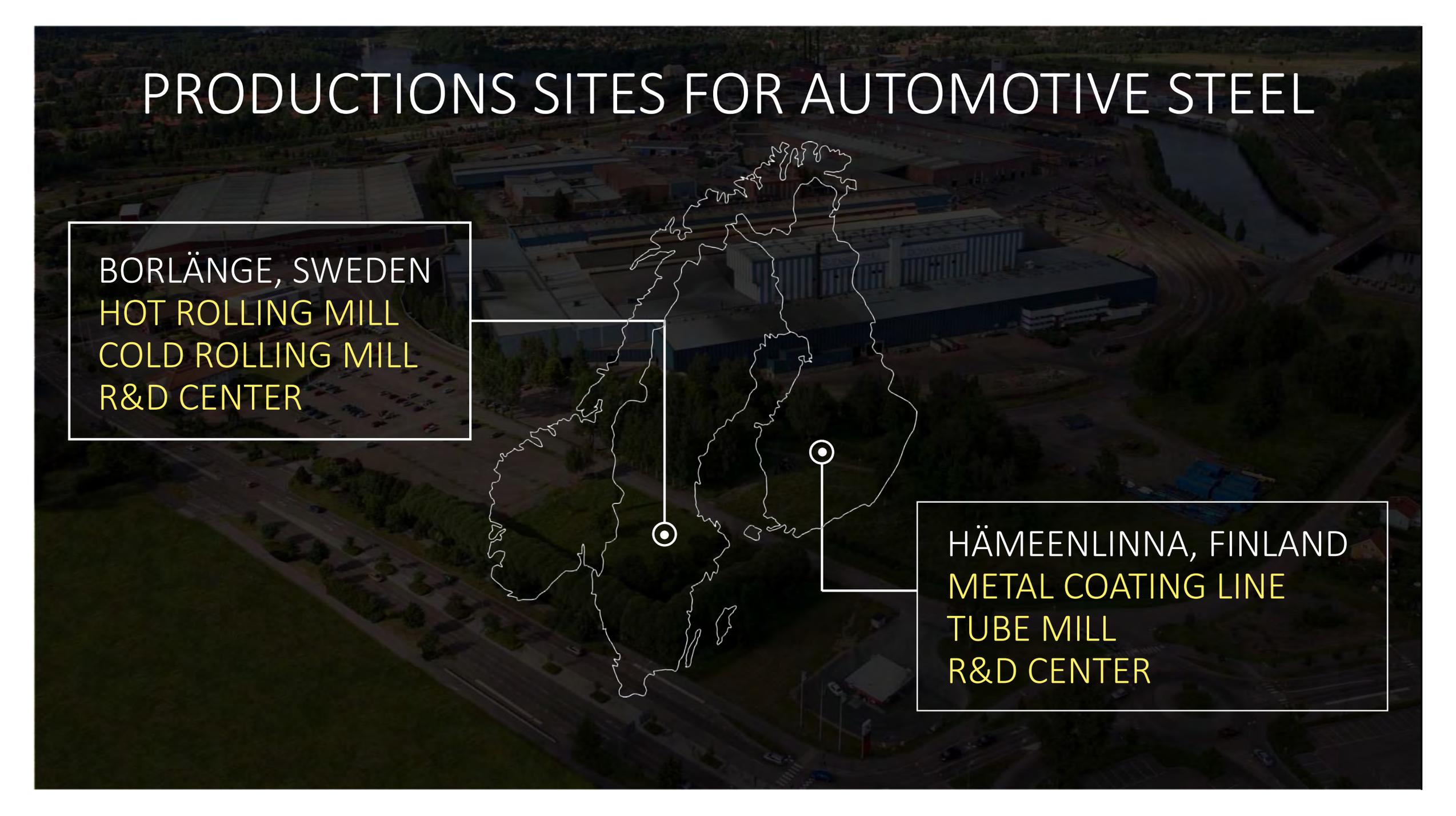
NORDIC AND
US-BASED
STEEL COMPANY



ABOUT 15 000
EMPLOYEES IN
50 COUNTRIES

SSAB AIMS TO BE ONE OF THE
SAFEST STEEL COMPANIES
IN THE WORLD.

PRODUCTIONS SITES FOR AUTOMOTIVE STEEL



BORLÄNGE, SWEDEN
HOT ROLLING MILL
COLD ROLLING MILL
R&D CENTER

HÄMEENLINNA, FINLAND
METAL COATING LINE
TUBE MILL
R&D CENTER

ABOUT A.E.D. MOTORSPORT



SPECIALTY METAL SUPPLIER TO THE GLOBAL AUTO SPORT AND AVIATION INDUSTRIES, PROVIDING HIGH STRENGTH TUBING FOR MANUFACTURING ALL FORMS OF COMPETITION COMPONENTS



DISTRIBUTION PARTNERS IN SWEDEN, AUSTRALIA, UK, JAPAN, CANADA, BRAZIL AND PUERTO RICO.

TIER 2 SUPPLIER TO AEROSPACE AND GENERAL AVIATION MFG'S.



A.E.D. IS THE ONLY METALS SUPPLIER TO ENGAGE WITH AUTO RACING GOVERNING BODIES IN REGARDS TO CRASH TESTING, REVIEWS AND EDUCATION ON MATERIAL CHOICES, BENEFITS AND AVAILABILITY.

TODAY WE HAVE OVER 250 MANUFACTURES USING DOCOL R8 TUBES FOR ALL OR PART OF THEIR CHASSIS AND COMPONENTS. DOCOL IS USED IN ALMOST EVERY AREA OF AUTO RACING AND POWER SPORT APPLICATION AROUND THE WORLD.



CHASSIS APPLICATIONS INCLUDE:

LATE MODEL AND MODIFIED STOCK CARS, SPORTS CARS, HOT RODS, SPRINT & MIDGET TYPE CARS, DRAG CARS, MOTORCYCLES, SNOWMOBILES, OFF ROAD TRUCKS, LAND SPEED CARS, PULLING TRUCKS, GO KARTS, RALLY CARS, SPORT PLANES, UTV's & ATV's, BICYCLES, AIRBOATS,

COMPONENT APPLICATIONS:

SUSPENSION MEMBERS, EXHAUST SYSTEMS, AIRCRAFT MOTOR MOUNTS, JACK HANDLES (RACING), BODY STAYS, WING STRUTS, BUMPERS & SIDE BARS, DOOR SAFETY BARS, WHEELIE BARS AND MANY MORE.

GOVERNING BODY APPROVALS:

SFI, FIA, SCCA, USAC, POWri, BMW CAR CLUB, PCA, WORLD OF OUTLAWS, LUCAS OIL LATE MODEL SERIES, TRANS AM, IMSA, NASA, SVRA, WORLD RALLY CAR, PIKES PEAK HILL CLIMB ASSOC., CAN AM MIDGET SERIES, NHRA, IHRA, AND MANY MORE



FIRST STOCK CAR BUILT OF DOCOL TUBE. *DIRT MODIFIED



FIRST DOCOL MIDGET



BAJA 1000 PRERUNNER TRUCK



GREEN GOBLIN PRO MOD DRAG CAR



TOP FUEL DRAGSTER "FRONT HALF"

B56 Dragracing Team



LATE MODEL

LARGEST USER



FORMULA STUDENT



NASA UNLIMITED TIME TRIAL CAR



DIRT DRAGSTER



BLACKWING AVIATION SPORT PLANES



CRASH TESTING - 4130 SPRINT CAR

DOCOL TUBE CLEAN FINISH



CLEAR HEAT SIGNATURE



FASTER TO WELD AND FAB

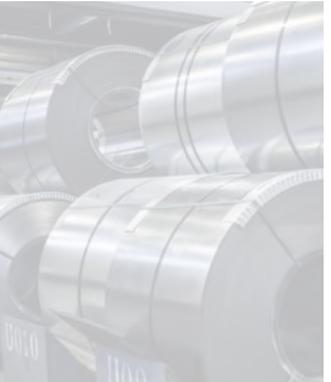


NEW CHOICE OF CHAMPIONS OF THE PAST

OUR BRANDED PRODUCT OFFER

						
STRENX™ PERFORMANCE STEEL	HARDOX® WEAR PLATE	DOCOL™ THE AUTOMOTIVE STEEL	TOOLOX® ENGINEERING & TOOL STEEL	ARMOX® PROTECTION PLATE	GREENCOAT® COLORFUL STEEL	SSAB DOMEX / BORON FORM / WEATHERING LASER PLUS
A game changer in steel performance	Hard and tough for maximum uptime	The automotive steel	Better tool performance	Hardest steel for maximum protection	For harsh weather and greener living	Optimized families

OUR AUTOMOTIVE BRAND

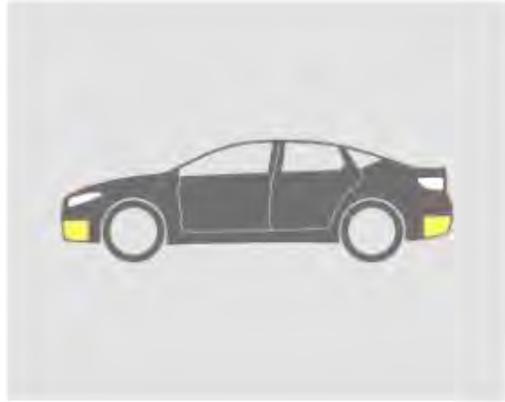
						
STRENX™ PERFORMANCE STEEL	HARDOX® WEAR PLATE	DOCOL™ THE AUTOMOTIVE STEEL	TOOLOX® ENGINEERING & TOOL STEEL	ARMOX® PROTECTION PLATE	GREENCOAT® COLORFUL STEEL	SSAB DOMEX / BORON FORM / WEATHERING LASER PLUS
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THE AUTOMOTIVE STEEL

AUTOMOTIVE STEEL AND AUTOMOTIVE INDUSTRY APPLICATIONS



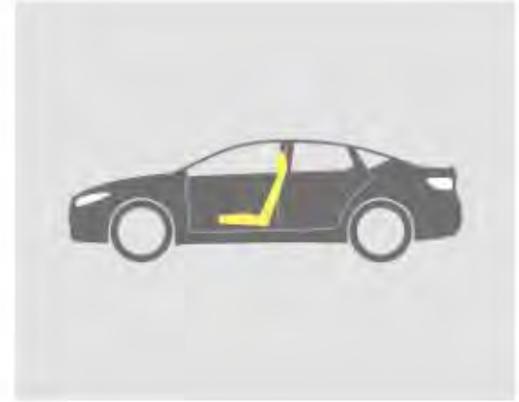
Bumpers



Chassis



Door beams



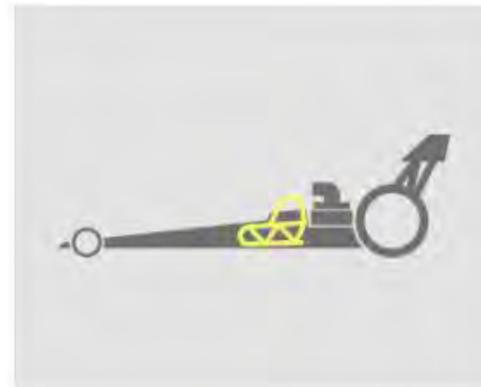
Seating



Structural body parts



Battery protection



Racing cars

OEM CUSTOMER REFERENCE

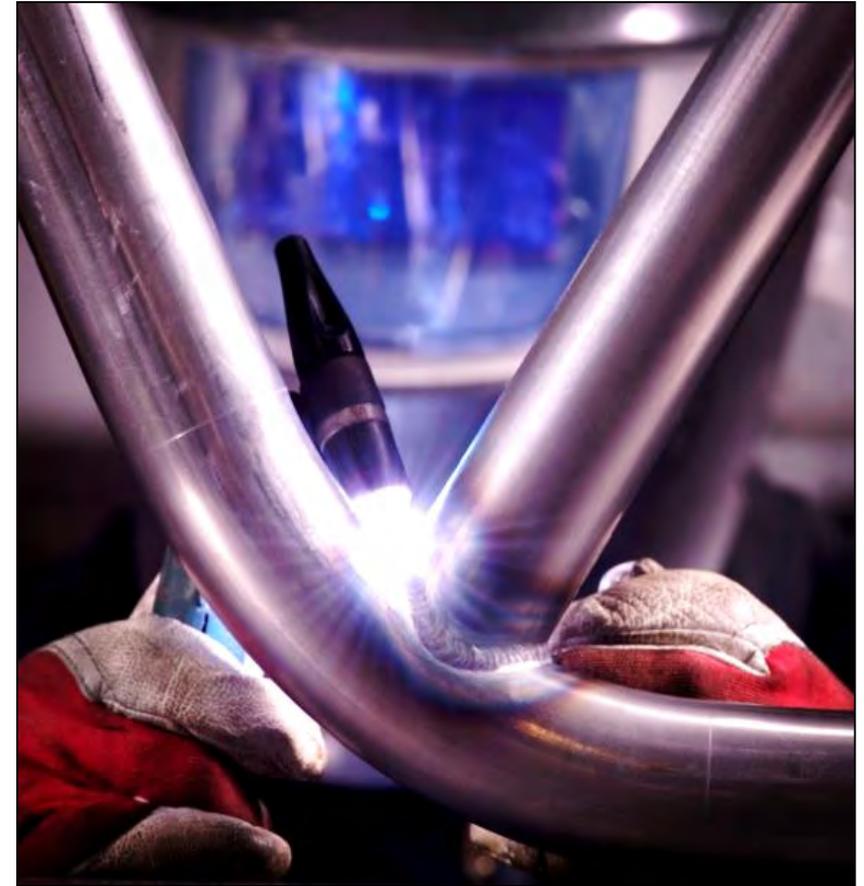


ADVANCED HIGH STRENGTH STEELS MAKE THE DIFFERENCE



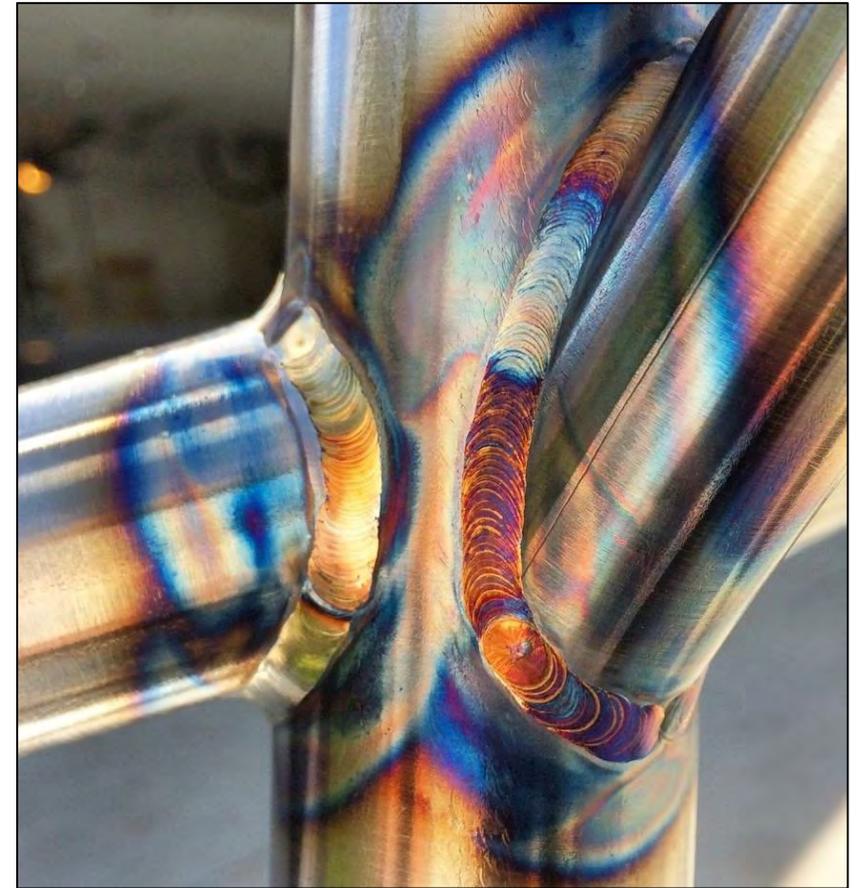
What is Docol R8 Tube?

Docol R8 Tube is a Advanced High Strength Steel (AHSS) that is stronger, safer and more consistent to work with. It allows you to create racing chassis and components that deliver the highest performance.



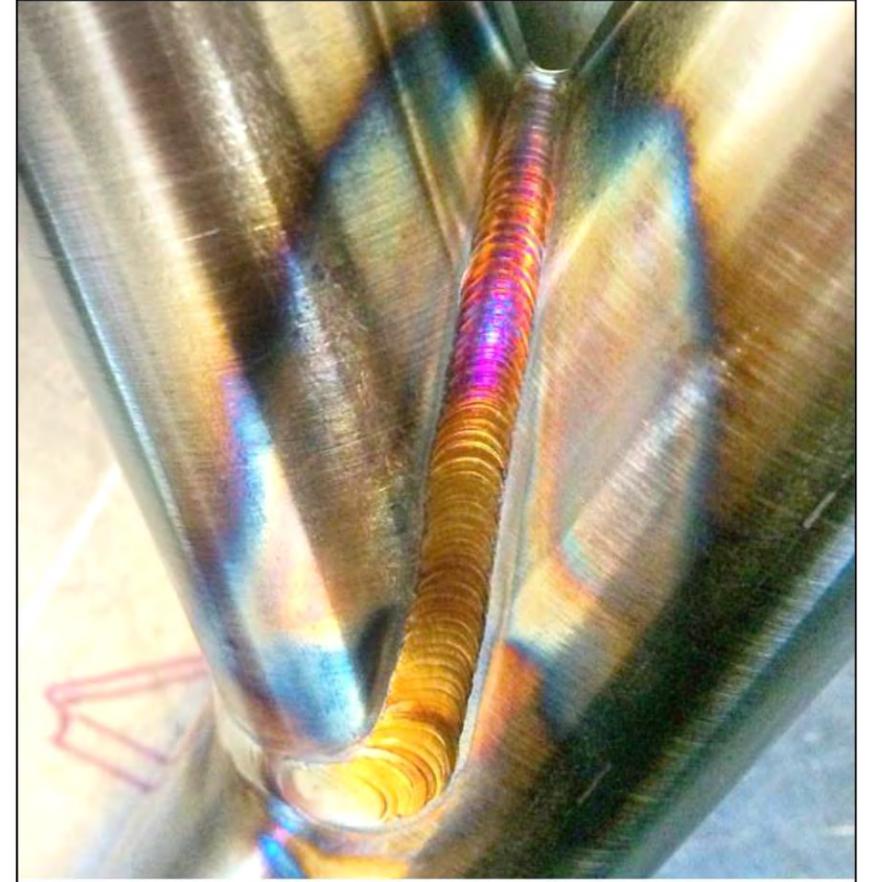
Why Docol R8 Tube?

- Docol is a Dual-Phase, high Tensile Strength → A lot of energy absorption with a controlled failure mode
- Docol is low carbon content → Very easy to weld
- Docol has very good internal cleanliness → Better performing mechanical properties
- Docol has iron oxide free surface so no pre-weld surface preparation is required to remove on interior or exterior → minimizes risk of weld defects such as porosity
- The bright surface finish easier to “read” the weld puddle during welding and see affect of heat input



Why Docol R8 Tube?

- Docol is produced by SSAB starting from the iron ore and processed entirely in-house.
- Docol has consistent dimensional and mechanical properties because Docol is an automotive grade material being held to strict tolerances. Typical thickness tolerances are +/- 0.05mm in thickness throughout the entire coil
- SSAB has engineers, metallurgists, specialists and technical support personnel for our customers to help them choose the right grade of material, correct applications, designs, forming, cutting, machining and welding support.



Weldability

Welding of AHSS is nothing new or revolutionary as it has been done for many years now and it doesn't differ significantly from welding of mild steels.

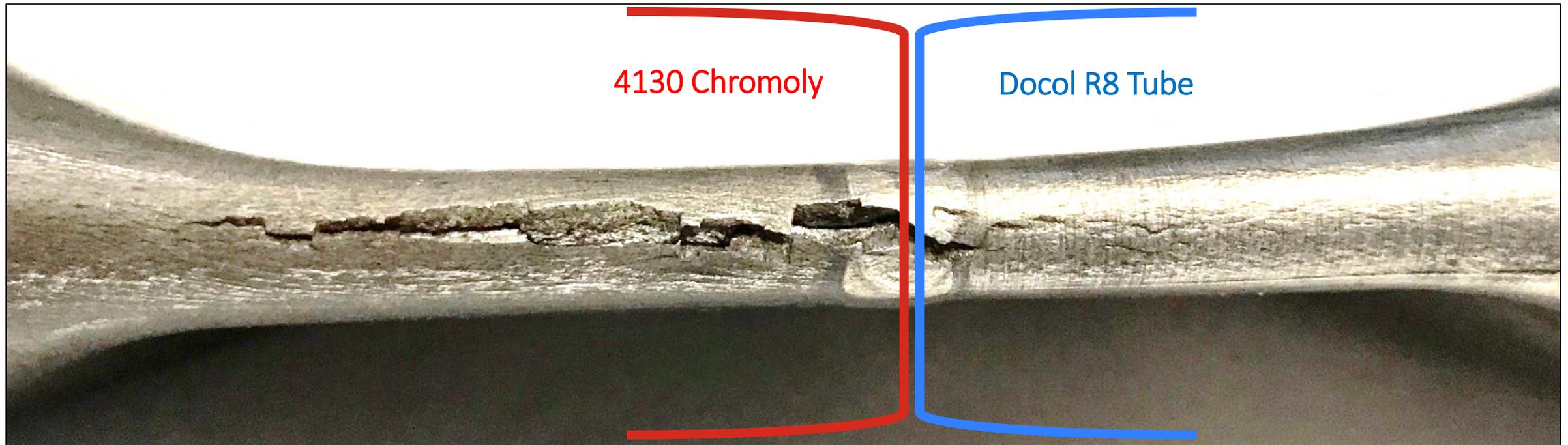
The weldability of the steel depends mainly on the steel composition. It is easy to increase the strength of the steel by putting alloying elements into the steel such as C, Mn, Mo, Cr, etc. A major drawback by doing that is that the weldability of the steel will be affected and with normally much poorer results. A steel with too high amount of alloying elements could be sensitive to hydrogen cracking during the welding operation. By using the effect of microalloying elements together with a controlled cooling and rolling in the mill, it's possible to reduce the amount of alloying elements to a minimum which is beneficial for the weldability of the steel.

Sample	C	Si	Mn	P	S	N	Al	Cr	Cu	Ni	Mo	Nb	V	Ti	CEV
Docol	0.12	0.2	1.53	0.016	0.001	0.004	0.042	0.01	0.01	0.04	0	0.015	0.01	0	0.38
4130 Cr-Mo	0.29	0.24	0.56	0.013	0.011	-----	0.018	0.93	0.08	0.03	0.18	0.001	0.01	0.003	0.61

$$CE_{IIV} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15} (\text{weight}\%)$$

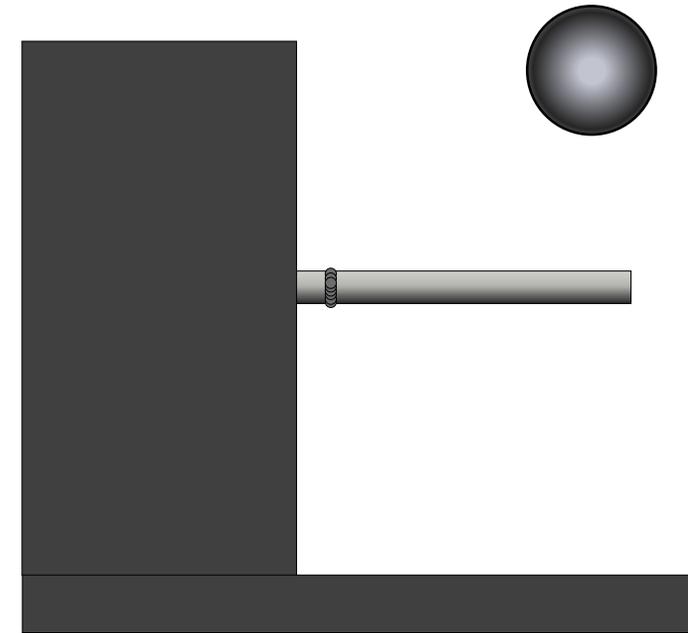
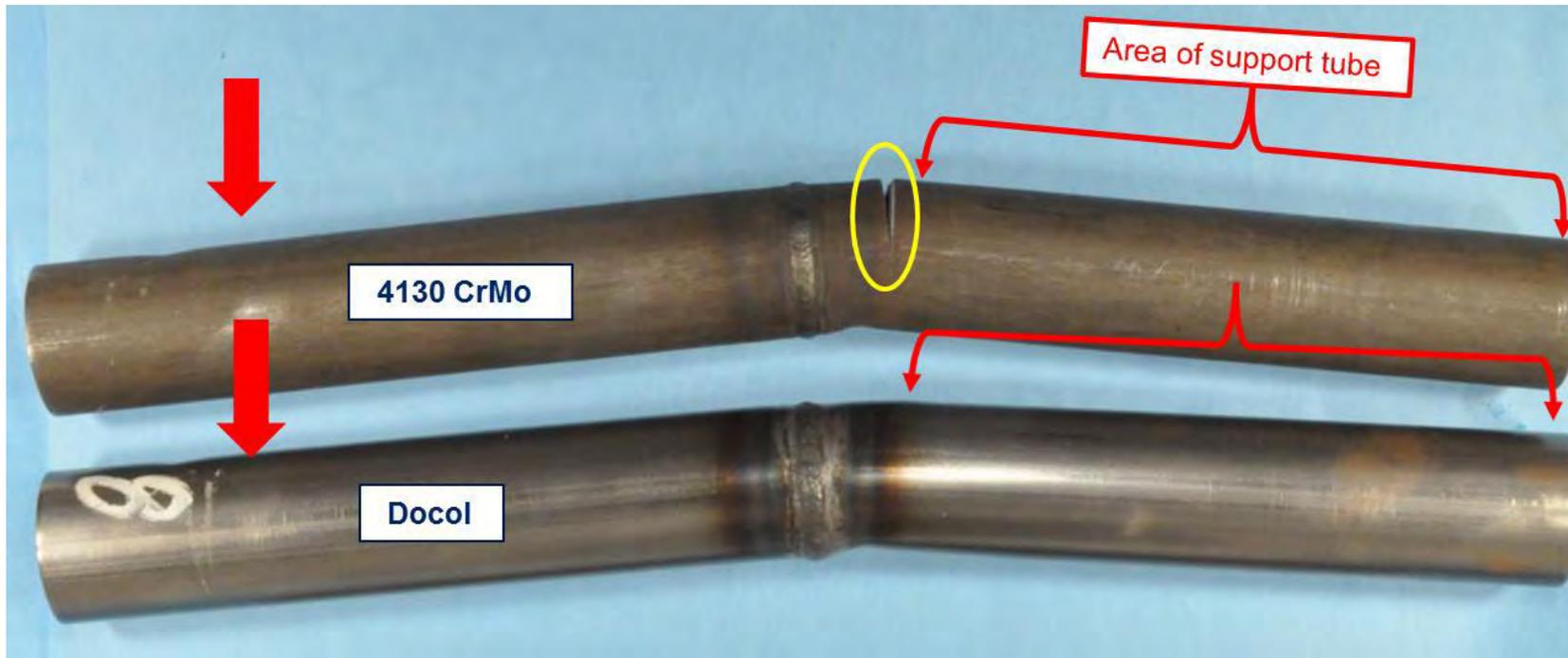
Heated Affected Zone (HAZ)

- High Carbon, Molybdenum and Chromium increases the hardenability and brittleness of the HAZ in 4130
- Flattening test result in cracks in the HAZ 4130



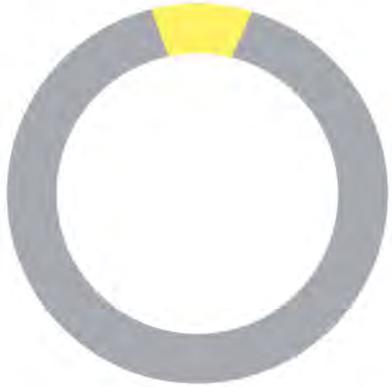
Heated Affected Zone (HAZ)

- The HAZ in Docol Tube R8 is much less in area than 4130 and less brittle, but retains better elongation and necking than 4130

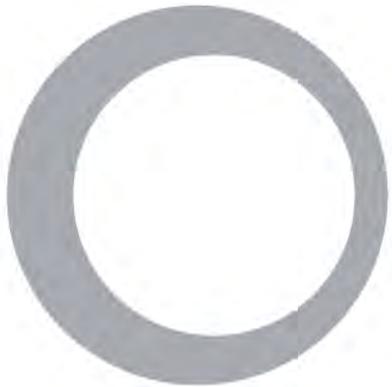


Drop weight testing of butt welded sample

Thickness tolerance



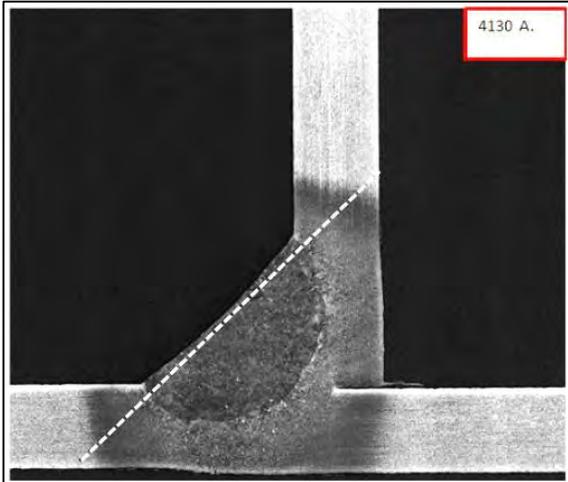
Cross section of Docol R8 Tube



Cross section of a cold drawn tube with variations in wall thickness



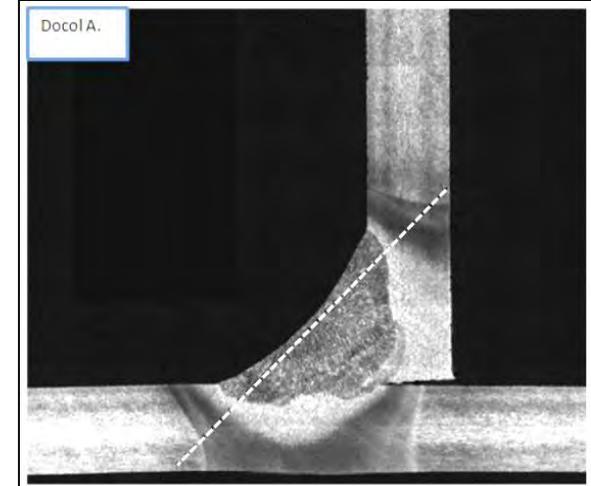
Micro hardness of welded sample Docol R8 Vs. CrMo 4130



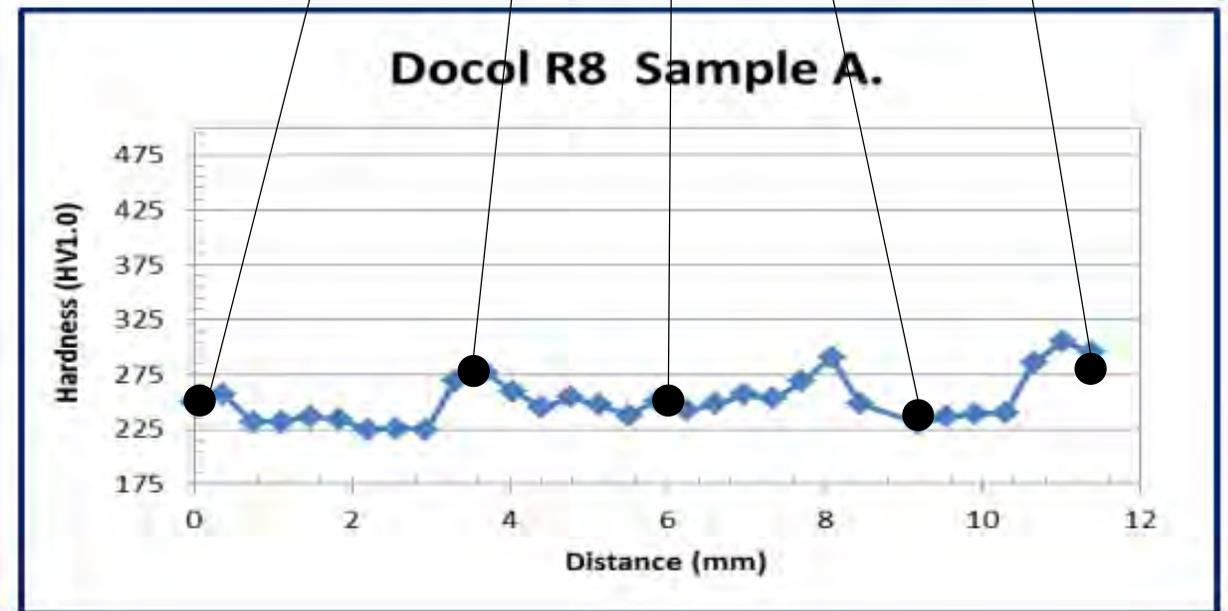
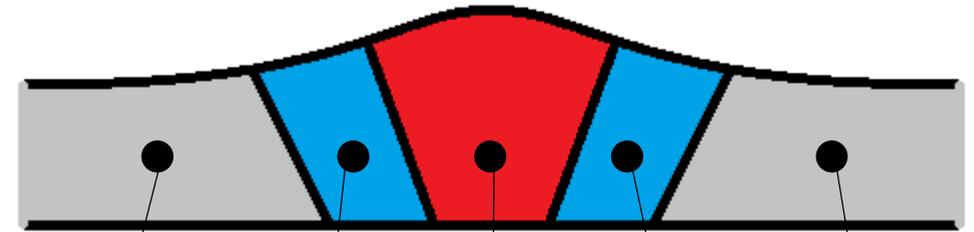
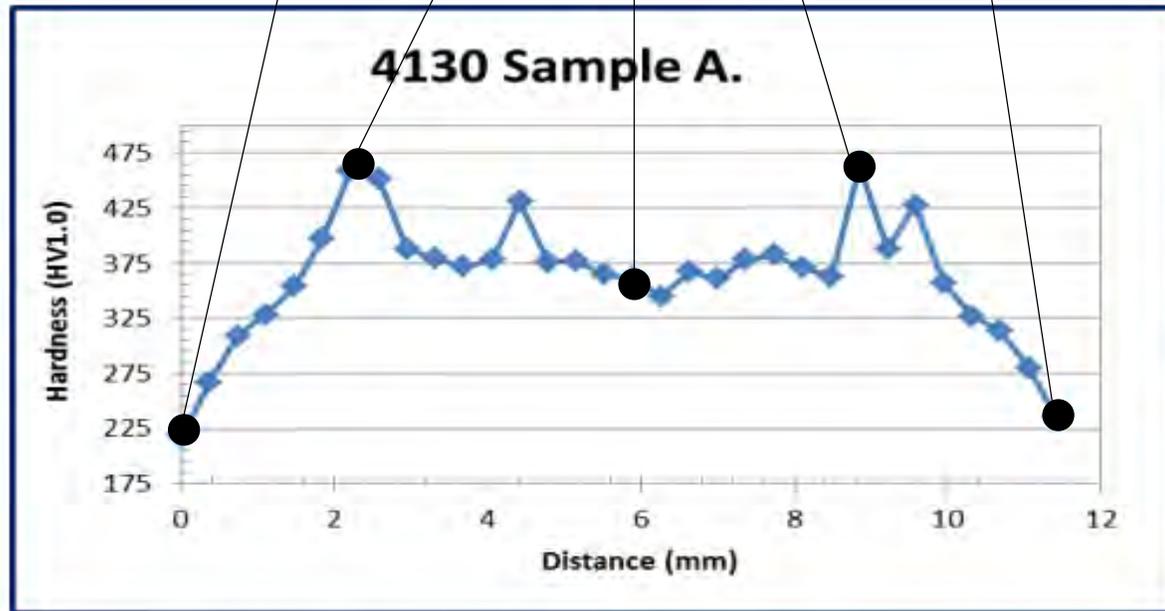
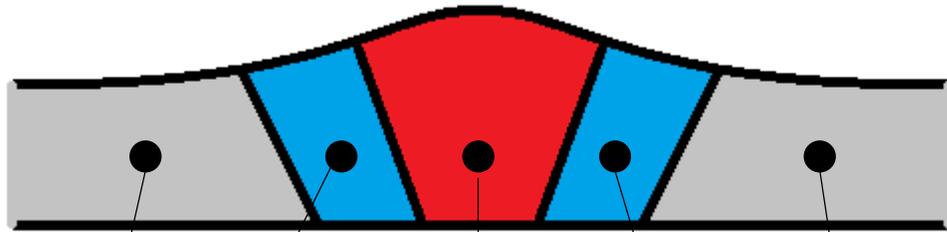
- Samples welded by Ryan Linder @ X-1 Race cars using the same weld parameters
- Tube sample dimensions for both the 4130 and Docol R8 are 1.50" diameter X .095" wall thickness
- 100% Argon shielding gas @ 22 cfm with 5 second post-flow
- #12 gas lens
- 3/32" 2% lanthanated with medium ground point taper
- 1/16" ER80S-D2 filler metal

Tube preparation:

- 4130 weld joints sanded with 220 grit disc action pad, finished with Scotchbrite with non-chlorinated brake cleaner.
- Docol R8 cleaned with non-chlorinated brake cleaner.
- Double pass weld consisting of a small weld, then going back over the same weld making the finished weld larger in size.
- Pulsing is a technique where the welder can vary the amperage by "pulsing or also known as pedaling" the remote amperage control whether it be a foot pedal or hand control. By adding short bursts of high amperage followed by a slightly longer time of low amperage enables the welder to add filler metal in a timed sequence.



Micro hardness of welded sample Docol R8 Vs. CrMo 4130



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Thanks!

