



# HIGH COUNTRY FABRICATION

1000 West First Street, Casper WY 82604

[www.hicofabrication.com](http://www.hicofabrication.com)

Email:[hico@hicofab.com](mailto:hico@hicofab.com)

307-235-0189



# High Country Fabrication (HICO)



- Established May 21, 1978
- 12.5 total acres
- 98,000 ft<sup>2</sup> under hook, 78,000 ft<sup>2</sup> shop space
- 240,000 lbs. lifting capacity
- ½ mile internal rail system connected to Burlington Northern Railway spur



# Engineering Standards, Certificates, & Organizational Affiliations



- ASME – Section VIII, Div.1
- National Board “U” and “R” Stamps
- HTRI – Heat Transfer Research, Inc.
- API – American Petroleum Institute
- TEMA – Tubular Exchanger Manufacturers Association, Inc.
- NACE – National Association of Corrosion Engineers
- ASNT – American Society for Non-Destructive Testing
- DDS – Solid Works Certified Professionals



# Engineering & Design



## Engineering Department

- Four Mechanical Engineers
- Three Full Time Designers

## Engineering & Design Software

### Codeware – Mechanical

- COMPRESS
- Nozzle Pro (FEA Utility)

### HTRI – Exchanger Rating

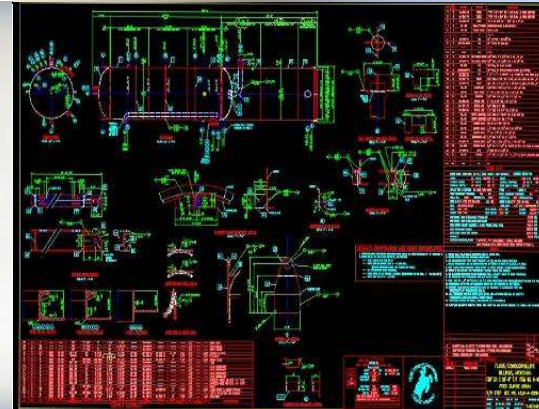
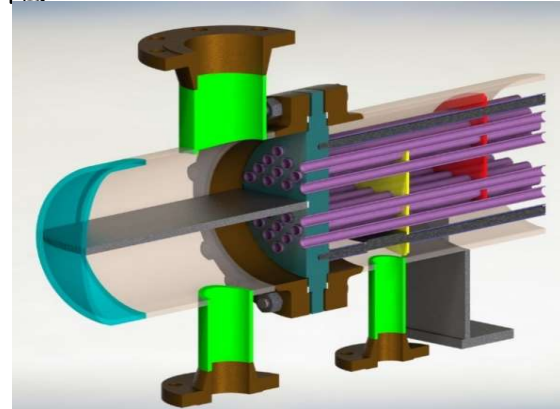
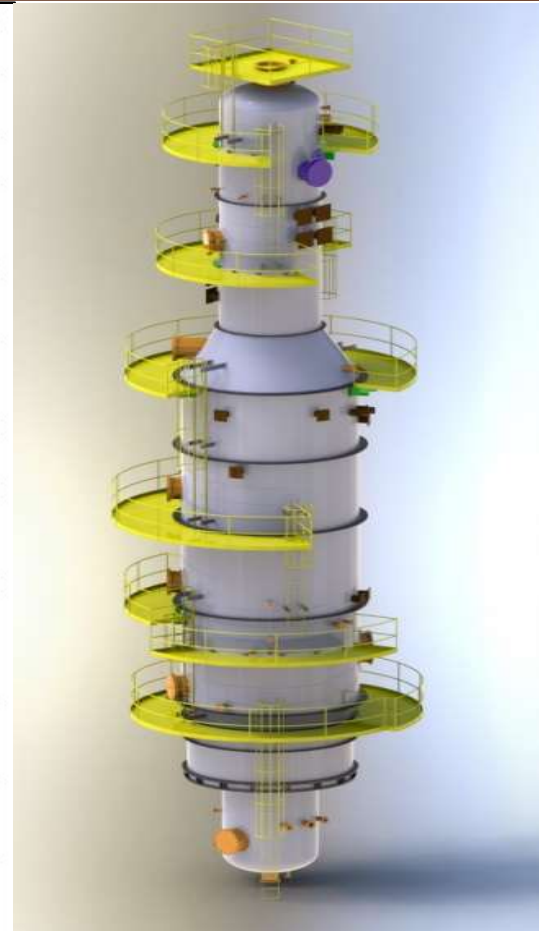
- Xchanger Suite
- Xist – Shell and Tube
- Xvib – Vibration

### Solidworks 3D Modeling, Drafting, & Simulation

### AutoCAD – Drafting

### Pronest 2019

HTRI		Vibration Analysis		Page 1
Released to the following HTRI Member Company: HICO LLC, dba High County Fabrication Harold Bayly				
Xist Ver. 6.00 12/21/2009 9:36 SN: 1500213589		US Units		
Shell 1				
Rating - Horizontal Multipass Flow TEMA BEU Shell With Single-Segmental Baffles				
1 Shellside condition	Sens. Liquid	(Level 2.3)		
2 Axial stress loading (1000 psi)	0.000	Added mass factor 1.761		
3 Beta	4.000			
4	Position in The Bundle			
	Inlet	Center	Outlet	
5 Length for natural frequency (ft)	1.904	1.635	2.342	
6 Length/TEMA maximum span (-)	0.397	0.327	0.488	
7 Number of spans (-)	12	12	12	
8 Tube natural frequency (Hz)	165.3	164.4	137.7	
9 Shell acoustic frequency (Hz)				
10	Flow Velocities			
	Inlet	Center	Outlet	
11 Window parallel velocity (ft/sec)	1.69	1.60	1.58	
12 Bundle crossflow velocity (ft/sec)	0.68	0.94	0.48	
13 Bundle/shell velocity (ft/sec)	0.45	0.82	0.32	
14	Fluidelastic Instability Check			
	Inlet	Center	Outlet	
15 Log decrement HTRI	0.038	0.038	0.038	
16 Critical velocity (ft/sec)	24.31	35.08	16.93	
17 Baffle lip cross velocity ratio (-)	0.0304	0.0291	0.0309	
18 Average crossflow velocity ratio (-)	0.0279	0.0287	0.0284	
19	Acoustic Vibration Check			
	Inlet	Center	Outlet	
20 Vortex shedding ratio (-)				
21 Chen number (-)				
22 Turbulent buffeting ratio (-)				
23	Tube Vibration Check			
	Inlet	Center	Outlet	
24 Vortex shedding ratio (-)	0.014	0.020	0.010	
25 Parallel flow amplitude (inch)	0.0000	0.0000	0.0000	
26 Crossflow amplitude (inch)	0.0000	0.0000	0.0000	
27 Tube gap (inch)	0.1675	0.1675	0.1675	
28 Crossflow RHCO-V-SQ (lb-ft-sec <sup>2</sup> )	13.94	28.08	7.88	
29	Bundle Entrance/Exit (analysis at first tube row)			
	Entrance	Exit		
31 Fluidelastic instability ratio (-)	0.082	0.103		
32 Vortex shedding ratio (-)	0.035	0.030		
33 Crossflow amplitude (inch)	0.00010	0.00018		
34 Crossflow velocity (ft/sec)	1.62	1.42		
35 Tubesheet to inlet/outlet support (inch)	None	None		
36	Shell Entrance/Exit Parameters			
	Entrance	Exit		
37 Impingement plate	No			
38 Flow area (ft <sup>2</sup> )	0.121	0.082		
39 Velocity (ft/sec)	3.20	4.37		
40 RHCO-V-SQ (lb-ft-sec <sup>2</sup> )	311.22	826.71		
41 Shell type	BEU	Baffle type	Single-Seg	
42 Tube type	Plain	Baffle layout	Parallel	
43 Pitch ratio	1.2500	Tube diameter, (inch)	0.7500	
44 Layout angle	30	Tube material	Carbon steel	
45 Number U-Bend supports		Support/baffle space		
46	Program Messages			
47	* Frequency ratios are based upon lowest natural or acoustic frequency			
48	* Items with asterisk exceed a conservative lower limit for vibration-free design. Review your case			
49	using the procedure described in Online Help. You may find that a vibration problem is unlikely.			
50				





# In-House Quality Control and NDE

## ASME Codes and Standards

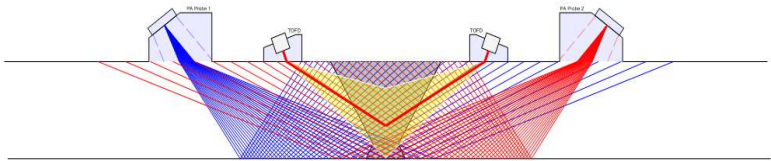
- Section II A – D Material Specifications
- Section V – Non-Destructive Examination
- Section VIII, Div 1 – Pressure Vessels
- Section IX – Standard for Welding Procedures



## In-House Capabilities and Qualified Technicians

- (AUT, UT) Ultrasonic, Automated & Manual – (1) Level III
- (RT) Radiographic Gamma Ray – (1) Level III, (2) Level II
- (WFMT, CCMT) Magnetic Particle – (1) Level III, (2) Level II
- (CCPT, FPT) Liquid Penetrant – (1) Level III, (2) Level II
- (VT) Visual – (3) Level II VT & (1) CWI
- (BHT) Hardness
- (PMI) Positive Material Identification – (4) Trained Operators
- Ferrite Content

# Automated Ultrasonic Testing (AUT)



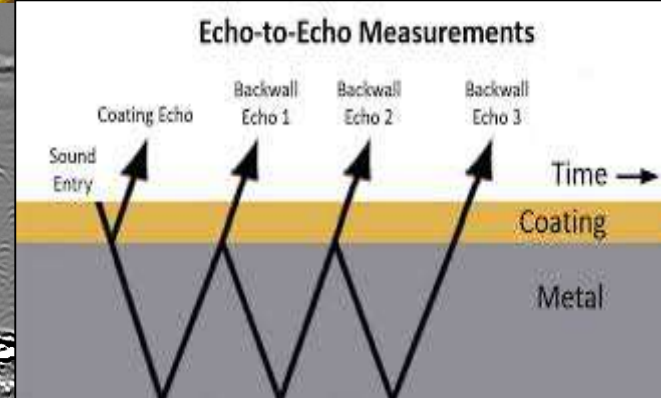
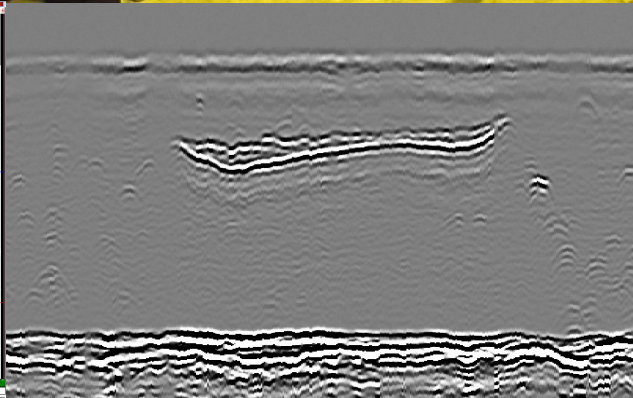
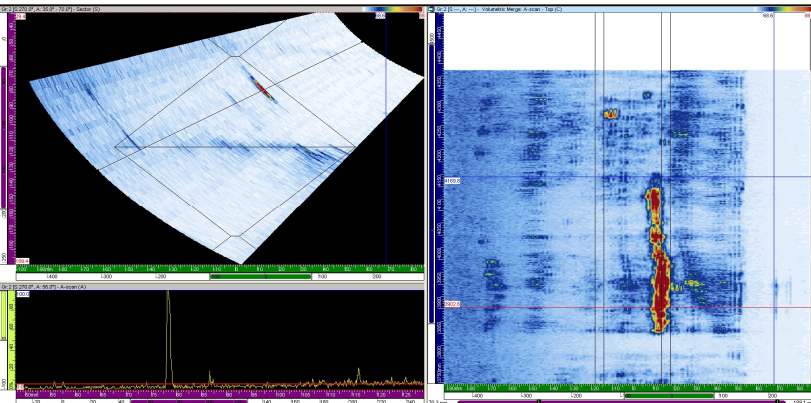
Eclipse Scientific ESBeamTool 3 -  
Used to determine probe placement  
for complete coverage of weld for any  
type of weld configuration



## Olympus OmniScan MX3

Olympus Flex Scanner  
Phased Array and time-of-flight diffraction capabilities

Inspect material > 1" up to  
12" thick, carbon and  
stainless steel



## Olympus TomoView Data Analysis Software

- Ability to easily detect and accurately measure flaws using both phased array and TOFD
- All data interpretation is verified by UT Level III technician  
(Same defect shown in both views above)

# Industrial Radiography (Gamma Ray)



Survey Meter, Camera

- Two SPEC 150 Iridium-192 cameras with 150ci capacity for inspection of material up to 3" thick
- Licensed for Cobalt-60 source for inspection of material above 3" thick
- GE Industries Nova Automatic Processor for fast and consistent development



Dark Room, Chemical Mixers, Silver Recovery, Automatic Processor



# Fabrication Materials and Process



## Welding Processes

- SMAW – Stick
- SAW – Submerged Arc
- GMAW – MIG
- GTAW – TIG
- FCAW – Flux Core
- ESW – Electro-slag
- SW – Stud Welding



## Materials of Construction

- P1 – Carbon Steel
- P3 – Low C / Moly
- P4-5B – Chrome
- P6-7 – 400 Series Stainless
- P8 – Stainless
- P10H – 2205 Duplex
- P41-43 – Ni 200/400/600
- P44 – C276 Hastelloy
- P45 – Incoloy 825







# Material Prep – Machining



## Drilling

- Quickmill – 8' X 15'
- American - 16' Dia. X 10" THK

## Vertical Boring Mills

- Bullard - 42"
- Schiess - 96"

## Horizontal Boring Mill

- Giddings & Lewis 72" X 60" X 36"

## Engine Lathe

- Lodge & Shipley - 28" X 14'

## Brake

- Pullmax 1" THK x 12' W 400 Ton





# Cutting & Beveling



5 Axis CSI Kodiak HPR400XD  
Plasma Cutting System

3.2" Thick Plasma Cutting

8" Thick Oxy Fuel Cutting

12'-6" Wide x 46'-6" Long Cut  
Table





# Rolling & Stacking Shells



## Rollers

- Pullmax 1.75" Thick, 10' W, 15' to 1.5' OD
- Hauseler 5.75" Thick, 10.5W, 4' to 20'OD





# Nozzle Prep and Installation



Shell Layout



Plasma Cut Neck Bevels



Insertion



Weld-out Nozzle

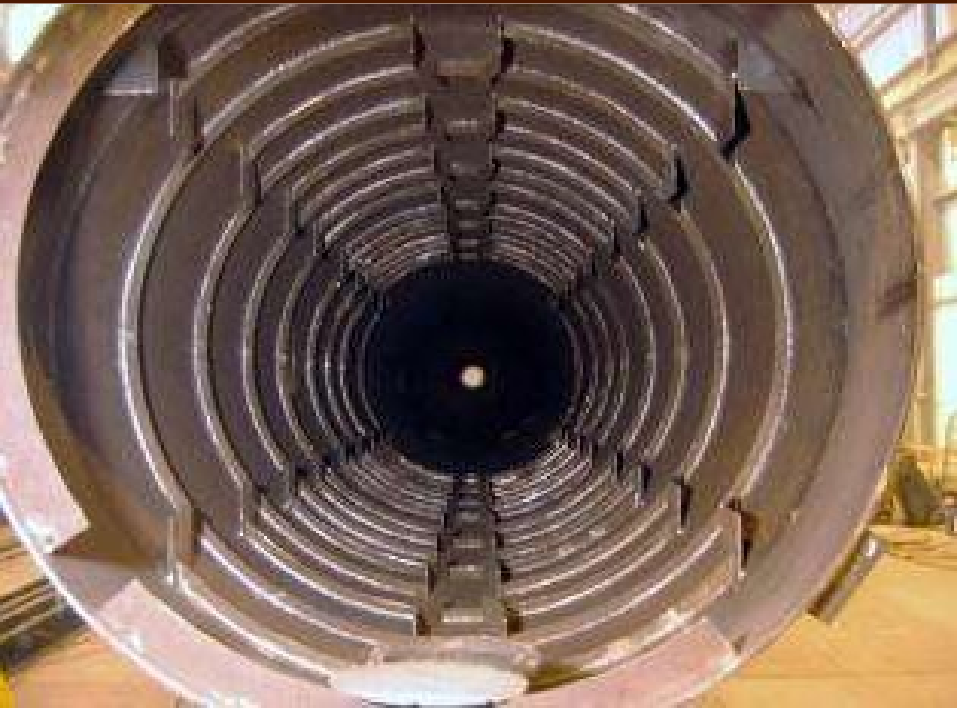


Repads



Sub-arc Flange

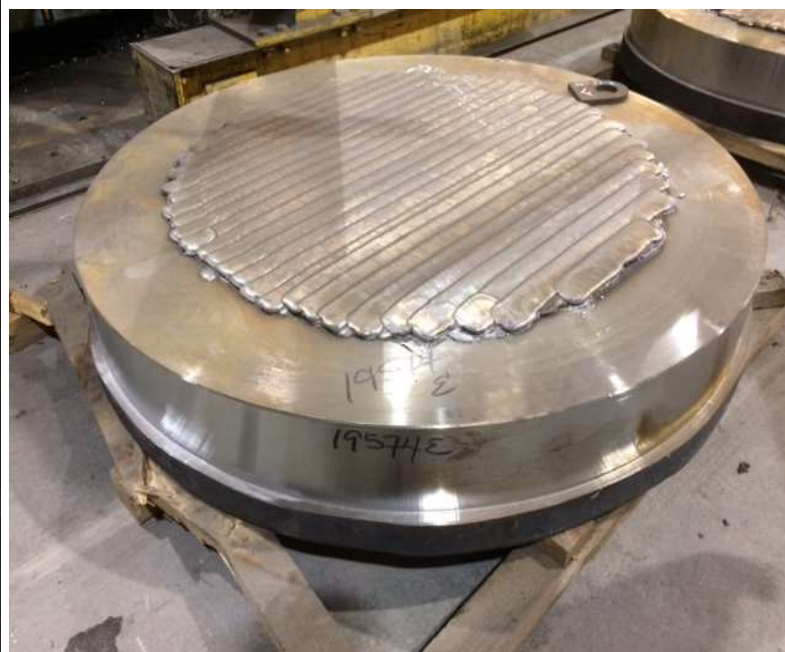
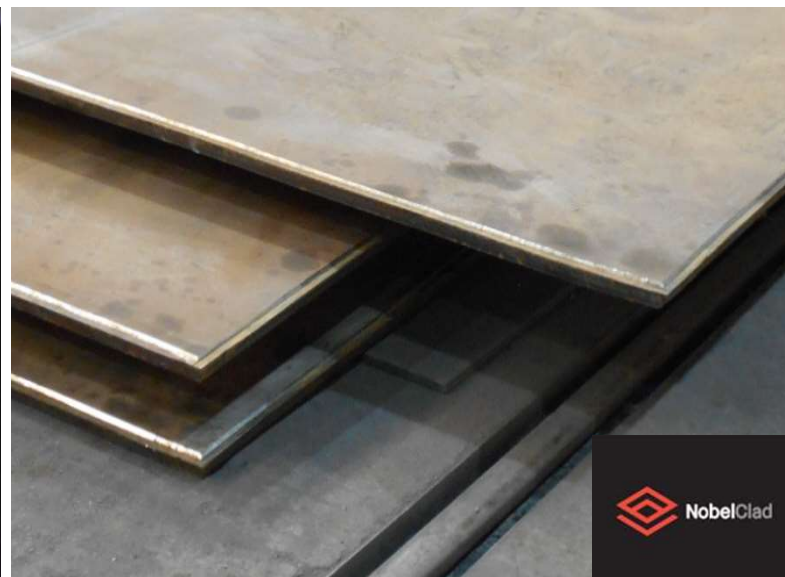
# Internal/External Installation Ladders and Platforms





# Cladded Vessels

Explosion Bonded Metals – 300 Series Stainless, 625 Inconel, Monel 400

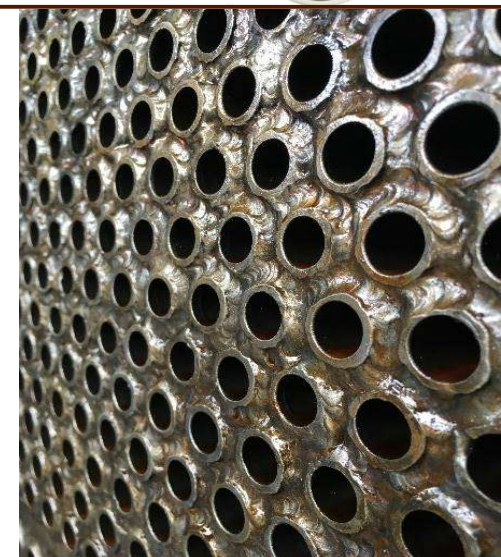




# Heat Exchangers



- TEMA Style Shell and Tube Heat Exchangers.
- Welded Tube to Tube Sheet Joint
- Engineered for guaranteed performance

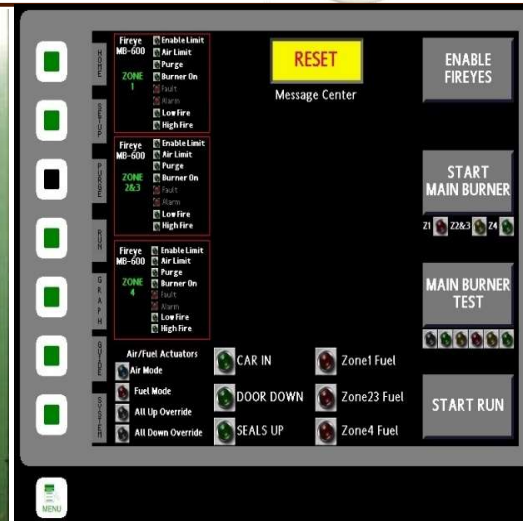




# Post Weld Heat Treat Oven

## Oven Specifications

- 54' L X 21' W X 15' H
- 110 Ton Car Capacity
- 2400 deg. F Max.
- Natural Gas - 25,656,000 BTU/hour







# Localized Post-Weld Heat Treatment



- 200 - 500 Amp Power Source
- 12 Zone control
- 24 point digital chart recording



# Hydrostatic Pressure Testing



- Heated 42,000 Gallons Storage Tanks
- Access to Low-Chloride City Water
- Treated W/ Corrosion Inhibitors

# Surface Preparation & Abrasive Blasting



- SSPC – Society for Protective Coatings
- SP-5 White Metal,
- SP-6 Commercial
- SP-7 Brush
- SP-10 Near White
- Silica Free Blast Media
- 3 Stations, 3/8" – 3/4" Nozzle, 90 psi
- Surface Contaminant Testing Capability





# Internal & External Coating

## High Performance Coatings

- High Temp Coatings up to 1200°F
- Acid Indicating
- Epoxy Mastics, Phenolic, & Novolacs
- Urethanes
- Silicone Alkyd
- Zinc

## NACE Level 2 & 3 Inspection

- Paint Adhesion Test
- Soluble Salts Test (chloride)
- Surface Profile Indication
- Final Film Thickness (DFT)
- Holiday Test



# Insulation, Fireproofing, Heat Trace





# Logistics

Acid Gas Exchanger, 16.5' OD, 310,000#, 65.5' Long, Pocatello, ID



Styrene Cond. 14'4" OD, 510,000#, Canada



Tower, 10.5' OD, 305,000#, 200' Long, Commerce City, CO



Reactor, 12' OD, 560,000#, 108.75' Long, Cheyenne, WY



Fractionator, 14' OD, 277,000#, 146.5' Long, Borger, TX

