SECTION I

DATA SHEET

A. General: The batch heat treating facility described herein, consists of one (1) integral quench batch furnace, SN1978; one (1) tempering furnace, SN1979; one (1) spray dunk washer, SN1980; one (1) transfer car, SN1981; one (1) scissors table, SN1982; one (1) stationary table, SN1983; one (1) carbon control system.

B. Integral Quench Batch Furnace:

1. Capacity and Performance:

Effective work space	24" W x 36" L x 24" H
Temperature range	1450°F-1750°F
Maximum temperature	1850°F
Temperature uniformity	±15°F
Work load	1100 lbs.
Max. Recovery Rate (varies w/temp)	550-1100 lbs./hr.

2. Recirculating Fan: . . . . . 20", 1050 cfm

3. Heaters:

Six (6) elect. elements	12 KW ea. = 72 KW or 12 w/ft.^{2}

4. Atmosphere Controls:

	Normal	High
Gas flows - Nitrogen	240 CFH	480 CFH
Methanol	1.5 gph (360 CFM)	

5. Quench capacity: . . . . . 1000 gallons

6. Agitators: (18" dia.) . . . . . 5200 gpm cap.

7. Cooling fan: . . . . . 2000 cfm @ 1" S.P.

8. Cooling gas flow: (nitrogen) . . . 100 cfh

C. Batch Tempering Furnace:

1. Heating range:	300-1000°F
2. Heaters: Two (2) elec. elements.	18 KW ea. = 36 KW
3. Fan:	4600 cfm

D. Spray Wash:

1. Work space	24" W x ~~36~~ 24" H x ~~24~~ 36" L
2. Work load	1100 lb.
3. Spray capacity (pump)	200 gpm @ 50' TDH
4. Wash solution temp.	180°F
5. Solution heater (electric)	4 @ 9 KW = 36 KW

E. Transfer Car:

1. Work space	24" W x ~~36~~ 24" H x ~~24~~ 36" L
2. Work load	1100 lb.
3. Work travel (each way)	6'-10"
4. Car speed	34.9 fpm
5. Pusher speed	23.5 fpm

F. Lift Table:

1. Work space	24" x 48"
2. Work load	1100 lb.
3. Lift travel	14" - 56"

G. Load Table:

1. Work space	24" x 48"
2. Work load	1100 lb.

SECTION II

DRAWING INDEX

BATCH FURNACE & QUENCH

SPRAY WASH

TRANSFER CAR

SCISSORS LIFT TABLE

SECTION III

EQUIPMENT DESCRIPTION

A. SAUDER 24-36-24 INTEGRAL QUENCH BATCH FURNACE

1. General Description:

The SAUDER 24-36-24 electrically heated integral quench furnace is a batch type unit equipped with recirculating roof fan, heating elements, rear handler, enclosed vestibule, overhead cooling chamber, and integral quench tank. The furnace is designed for neutral hardening, carburizing, normalizing, carbonitriding, and other heat treating processes where a controlled environment is required during the heating and quench portions of the cycle. The effective work dimensions are 24" wide by 36" long by 24" high.

The furnace is designed for a normal operating temperature range of 1450°F to 1750°F with a maximum of 1850°F and has a temperature uniformity of plus or minus 15°F when thoroughly soaked out and operating on repetitive cycles.

2. Capacities:

The furnace has sufficient heat input to heat the following gross pounds per hour to furnace operating temperature. It should be noted that actual heating rates vary from load to load, depending on the ability of the work to absorb the available heat and the geometric configuration of the load.

Furnace Temperature	1450	1500	1550	1600	1650	1700	1750
Max. Gross Load	1100	1100	1100	1100	1100	1100	1100
Max. Recovery Rate (Gross pound per hour)	1100	1100	1100	880	680	600	550

3. Furnace Casing:

The furnace casing is fabricated of 3/16" and 1/4" steel plate, welded gas-tight and suitably reinforced with structural angle, channel, and beam.

A ladder is located on the backwall of the furnace to enable easy maintenance for radiant tube removal and fan repair.

8. Automatic Handling System (Continued)

The cycle begins when the operator pushes the work into the vestibule, using the transfer car, retracts the handler head, closes all doors, and pushes the "Cycle Restart" button. When the vestibule is purged, the inner furnace door opens and the rear handler pulls the work into the heated chamber, and the door closes. The work load is then heated to temperature and the soak timer is engaged at this point. When the soak timer times out, the furnace door is raised, and the work is pushed onto the quench elevator and down into the quench tank. This motion will start the quench timer. When the quench timer times out, the load is lifted to the vestibule area and a light is lit to notify the operator that the furnace is ready to be unloaded.

9. Electric Heating System:

SAUDER utilizes metallic rod-type electric elements operating in protective containers similar to radiant tubes. Once installed, this design allows for changing elements externally without completely cooling the furnace to get inside. The elements are supported by the protective containers which are made of thirty-five percent nickel, fifteen percent chrome alloy.

The temperature control system is a "current" adjusting type (CAT) to drive the SCR power supply. This combination provides a full proportioning, soft-start control.

The furnace design accepts 6 elements at 12 kilowatts per element or 72 kilowatts. Element ratings are based on a maximum design of approximately 12 watts per square inch of element surface area.

SAUDER provides a zero voltage firing SCR package, with enclosure.

The heating system is provided with the recommendations of FM/IRI underwriters.

10. Temperature Controls:

The furnace has one (1) zone of control. The following instrumentation is supplied:

10. Temperature Controls (Continued)

1 ea. - Marathon Monitors, UP100 UNIPRO, temperature controller, calibration type K.

1 ea. - Barber Colman, Model 121L, indicating high limit instrument, type K calibration.

1 ea. - Barber Colman, Model Y10, strip chart recorder, single pen, calibration type K.

2 ea. - Type K thermocouples with protection tubes.

Please note that the Marathon Monitors UNIPRO temperature controller is interfaced with the Marathon Monitors programmable carbon controller as described herein below. The interfacing of the two (2) controllers allows for a programmable temperature control system.

The temperature control instruments, motor starters, pushbuttons, cycle controls and safety aids are mounted in a free-standing NEMA-12 enclosure. A main disconnect switch with door interlock is provided.

11. Atmosphere Controls (Nitrogen/Methanol):

Flowmeters are provided to measure and regulate the amount of nitrogen, methanol, ammonia and enriching gas being introduced into the furnace atmosphere. Each of the atmosphere gases are controlled by a solenoid valve and interlocked with the temperature control instrument to ensure that the gases cannot be introduced into the furnace below an operating temperature of 1400°F.

The normal rated gas flow for the furnace is 240 cubic feet per hour of nitrogen and 1.5 gallons per hour of methanol (360 CFH equivalent). When the system is on high flow (during load transfer and purging), the gas flow in the furnace is 480 cubic feet per hour of nitrogen. The high flow rate continues until the transfer motion is complete plus an additional two to four minutes after the inner door is closed.

In the event of an emergency shut-down due to power loss or atmosphere loss, a nitrogen purge solenoid valve is provided. This ensures a flow of nitrogen to the furnace during an emergency shutdown.

11. Atmosphere Controls (Nitrogen/Methanol) (Continued)

The atmosphere controls and flowmeters are mounted on a separate panel.

A separate inlet for nitrogen and for methanol is provided in the roof near the recirculating fan to insure proper mixing and heating of the atmosphere.

12. Atmosphere Interlock Equipment:

The SAUDER integral quench furnace is equipped with the recommendation of FM/IRI underwriters as a standard. The atmosphere interlock equipment includes:

- 1400°F temperature control contact
- Metering units
- Ammonia gas valve, solenoid type
- Atmosphere relay and selector switch
- Atmosphere alarm system
- Low gas pressure switch
- Methanol flowswitch
- Methanol flow alarm
- Methanol solenoid valve
- Nitrogen purge valve

13. Quench Tank and Vestibule:

The quench tank and vestibule assembly consist of the vestibule, vestibule door, quench tank, overhead cooling chamber and double deck elevator mechanism. This assembly is located at the front of the furnace heating chamber.

Vestibule: The vestibule is provided as a means of transferring a heated load from the furnace heating chamber into the quench tank under a protective atmosphere. It also serves as a purge chamber, before a loaded tray is charged into the furnace. The atmosphere in the vestibule also serves as a blanket to aid in reducing oxidation of the quenchant. Atmosphere is introduced into the vestibule from the heating chamber.

A 3/4" steel plate door is provided on the front of the vestibule. The door is pneumatically operated. A piloted flame screen, with flame supervision, is provided to ignite the atmosphere when the door is open.

The vestibule is fabricated of 1/4" steel plate suitably reinforced to form a rigid, gas-tight structure.

14. Quench Tank: The quench tank is fabricated of 1/4" steel plate, suitably reinforced with structural shapes to form a rigid, oil-tight and gas-tight structure. The quench tank capacity is 1000 gallons.

15. Elevator: A double deck-type elevator is provided to permit sequence charging, quenching and discharging in a minimum period of time. The elevator is pneumatically operated and guided by cam rollers riding in steel guides to provide a smooth motion and trouble-free operation. Each deck of the elevator is equipped with roller rails and steel chain guides to facilitate use with the transfer car handler mechanism.

16. Agitators: One (1) vertically mounted, 18" diameter, propeller-type agitator is provided. The agitator is supplied with a five horsepower drive motor. The drive provides quench recirculation of 5,200 gallon per minute. The quench tank has internal baffles to assure full flow of the recirculated quenchant through the work.

17. Oil Lever Control: A float-type level switch is provided to monitor quench medium levels and sound alarm for low level conditions. A dip stick in the quench overflow is provided for visual indication of the quenchant level.

18. Cooling System: AIR TO OIL (SBS)

The quench medium cooling system consist of a three horsepower recirculating pump and an ~~oil-to-water~~ type heat exchanger designed to cool the quench oil between 120°F to 160°F. ~~A shell and tube type heat exchanger with removable tube bundle for ease of cleaning is provided~~.

The temperature control system responds to the temperature of the quenchant as it exits the quench tank and causes an automatic valve to control the water flow.

19. Pneumatic Equipment:

The vestibule door and quench elevator is operated by pneumatic cylinders controlled by hand control valves. Each cylinder has both ends cushioned and use a chrome-plated rod. Flow control valves in the exhaust circuits are used to restrict flow and control the cylinder speed.

All pneumatic piping is installed and piped to a central point complete with a combination filter, regulator and lubricator unit.

20. Atmosphere Cooling Chamber:

An atmosphere cooling chamber is provided above the quench tank and vestibule. This chamber is designed to be cooled by plate coils on all four sides of the chamber. The cooling liquid may be water or oil from the quench tank system by means of a recirculating pump supplied by the PURCHASER.

When the quench elevator is in the "up" position, the elevator platform is sealed against the bottom of the top cool chamber. A fan rated at 2000 cubic feet per minute and driven by a two horsepower motor is provided in the roof. The fan forces the atmosphere down through the work. The atmosphere outlet is located in the elevator platform and vents into the vestibule. The rated atmosphere gas flow for the cooling chamber is 100 cubic feet per hour of nitrogen. An additional atmosphere flowscope and hand valve is provided for control.

B. SAUDER 24-36-24-1000 BATCH TEMPERING FURNACE

1. General Description:

The SAUDER 24-36-24 tempering furnace is equipped with a pneumatically operated door, recirculating fan, heating elements and roller rails. It is designed to accommodate loads directly from the batch integral quench. It is loaded and unloaded by the batch transfer car.

The furnace design incorporates a roof fan mounted from the center of the roof. The furnace utilizes an aluminized steel duct work with adjustable louvers which allows recirculation to take place both vertically and horizontally up through the work.

The furnace is designed for all heat treating processes within the 300°F to 1000°F ranges.

2. Casing:

The casing is fabricated of 3/16" steel plate, suitably reinforced to form a rigid type structure.

3. Insulation:

The furnace is insulated with 6" of high efficiency semi-rigid non-sagging batt type insulation. The insulation is clad with an aluminized steel covering.

4. Door:

A pneumatically operated furnace door is provided on the front of the furnace. The front door plate consists of a 3/8" thick steel plate. A manual four way valve is provided to operate the door cylinder.

5. Hearth Construction:

Two (2) cast HH (25-12) alloy roller rails with cast HH (25-12) alloy 3½" diameter rollers are provided to support the work. The roller rails are supported on 310 hot rolled alloy to allow for adequate flow of the heated gases under the work.

A fabricated alloy tray stop is provided at the rear of the furnace to protect the insulation. Additionally, a fabricated alloy chain guide is provided in the front of the heating chamber to guide the handler located on the transfer car.

6. Electric Heating System:

The heating system consists of two (2) incoloy sheathed heaters assembled in a plug fashion on each side of the top of the furnace. Each heater is rated at 18 kilowatts. The total connected heating load is 36 kilowatts. The heaters are controlled by an on-off control contactor.

7. Recirculation System:

A 4600 cubic feet per minute, 7 1/2 horsepower fan provides the air circulation in the furnace. The fan directs the flow down the sides of the interior ductwork. The air horizontally flows through the louvers located near the bottom of the ductwork and flows vertically up through the work and back to the fan.

All pneumatic piping is installed and piped to a central point complete with a combination filter, regulator and lubricator unit.

8. Temperature Controls:

The following temperature control equipment is provided:

1 ea. - Barber Colman 560 indicating controller, calibration type K, range 0-1200°F.

1 ea. - Barber Colman 121L hi-limit instrument, calibration type K, range 0-1200°F.

2 ea. - Thermocouple assemblies with 18" long inconel protection tubes, type K.

100 ft.- Thermocouple extension wire, type K.

The temperature control instruments, motor starters, pushbuttons, cycle controls and safety aids are mounted in a free-standing NEMA-12 enclosure. A main disconnect switch with door interlock is provided.

C. SAUDER 24-36-24 SPRAY WASH

1. General Description:

The SAUDER 24-36-24 heated spray wash is equipped with spray nozzles, roller rails, recirculating pump, tank, electric heating elements, and controls. The washer is designed primarily for the washing of parts to remove quench oil after quenching or light machine oil before processing.

The spray washer is 24" by 36" by 24" high effective and capable of handling a 1100 pound gross load.

2. Casing:

The casing is constructed of 1/4" steel plate suitably reinforced to provide a rigid, water-tight structure. An access bulkhead is supplied in the wash tank for easy maintenance.

3. Hearth:

The washing chamber has two (2) fabricated roller rails with cast iron rollers. The hearth is designed to be compatible with the transfer car.

4. Door:

The washer door is a vertical, pneumatically operated steel plate type door. The washer door is operated by a pneumatic cylinder controlled by a hand control valve, which starts the automatic cycle. The cylinder operates the door through a chain and sprocket mechanism.

5. Spray System:

The spray system consists of a 200 gallon per minute recirculating pump at fifty foot head, with a five horsepower motor. The pump supplies the heated wash solution to the spray nozzles located above and beside the work. An adjustable timer controls the amount of time the spray portion of the cycle operates.

Skimming nozzles located across the front of the washer direct a flat spray towards the rear of the washer. A skimming trough connected to the drain is located across the rear of the tank. This trough effectively skims off oil and dirt floating on the cleaning fluid.

A mechanical float-type level control is provided.

6. Electric Heating System:

The washer solution is maintained at a temperature of 180°F. Four (4) immersion heating elements, each rated at nine kilowatts, controlled by a contactor, are supplied.

An expansion bulb type indicating controller is used to maintain a constant set point in the washer.

All temperature controls, motor starters, pushbutton, timers, and the main disconnect are mounted in a NEMA-12 enclosure on the side of the washer.

7. Pneumatic Equipment:

The door cylinders have both ends cushioned and use a chrome plated rod. A flow control valve in the exhaust circuit is used to restrict flow and control cylinder speed.

All pneumatic piping is installed and piped to a central point complete with a combination filter, regulator, and lubricator unit.

8. Dunk System:

SAUDER provides a dunk system utilizing an elevator to jog the work up and down in the wash solution. The wash cycle begins with a timed immersion that jogs the work up and down in the wash solution, then the work is lifted to the hearth level and sprayed with wash solution and allowed to drain. An audible signal notifies the operator when the cycle is complete.

The elevator contains the roller rail hearth and handler chain guide, and is pneumatically operated. The pneumatic cylinder is controlled by a solenoid valve. An adjustable timer controls the amount of time the work is emerged in the washer solution.

The elevator is provided with two limit switches that cause the pneumatic cylinder to reciprocate and jog the work in the cleaning fluid throughout the immersion cycle.

D. SAUDER 24-36 TRANSFER CAR:

1. General Description:

The powered transfer car is designed to provided a means of transporting the work between the various stations of the batch heat treating facility. It is of sufficient size to handle a 24" by 36" by 24" effective load of 1100 gross pounds.

The transfer car frame is fabricated of structural shapes and plates mounted on flange wheels designed to operate on embedded ASCE 40 pound railroad rails.

The work handler consist of a heavy stiff chain mechanism which both pushes and pulls the work load by means of a dog-type pusher head. The car is designed to service furnace equipment on either side of the aisle. The chain has rollers mounted on the sides of the links so it can be guided in box channel section, and is powered by a gear motor chain drive with brake.

A gear motor chain drive with brake drives the car in both directions. Controls are mounted on the car.

The transfer car is designed to both load and unload all equipment quoted herein. It has the capability of loading and unloading the vestibule and heating chamber of the integral quench furnace.

E. SAUDER 24-48 SCISSORS LIFT STORAGE TABLE:

1. General Description:

The scissor lift storage table provides a means of holding the work loads at various steps in the heat treating process, in addition to aiding in the loading and unloading of work from 14" above the floor to the hearth level of the batch facility. It is of sufficient size to handle a 24" by 48" effective load of 1100 gross pounds.

The scissors lift table is powered by a self-contained, manually controlled hydraulic unit with a one horsepower electrical motor. The top of the table is designed to accept the work handler of the transfer car in the box channel section, located between two rows of load bearing rollers.

2. Safety Skirting:

A bellows type enclosure to protect the lift mechanism and hydraulics is provided. It completely encloses the underdeck area and prevents entry of persons or objects.

F. SAUDER 24-48 STATIONARY LOAD TABLE:

The stationary load table provides a means of holding the work loads at various steps in the heat treating process. It is of sufficient size to handle a 24" by 48" effective load of 1100 gross pounds.

The top of the table is designed to accept the work handler of the transfer car in a box channel section, located between two rows of load bearing rollers.

G. SAUDER CARBON CONTROL SYSTEM:

The SAUDER single point, single level carbon control system consists of one (1) Marathon Monitors carbon sensor probe, one (1) Marathon Monitors UNICARB UC10 programmable carbon controller, one (1) air reference supply, and one (1) solenoid gas additive valve. The system provides one (1) level of automatic carbon potential control in the furnace heating and soak zones.

The carbon sensor probe and air reference supply are mounted on the furnace. The carbon controller is mounted in a NEMA-12 enclosure. The solenoid gas valve is mounted in the atmosphere piping of the furnace.

The controller responds continuously to the electrical signals of the carbon sensor probe and regulates gas flow through the solenoid gas valve. This achieves accurate, repetitive control of surface carbon level at all temperatures. The system does not depend on sample gas, thereby reducing the potential for maintenance.

It should be noted that the Marathon Monitors programmable carbon controller is interfaced with the Marathon Monitors UNIPRO temperature controller, therefore providing programmable temperature control.