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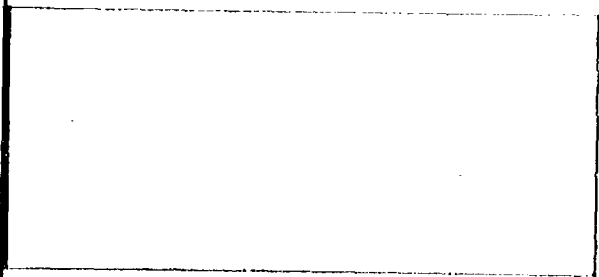
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# Refractomet Division

UNIVERSAL-CYCLOPS STEEL CORPORATION

## Technical Report



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Bridgeville, Pennsylvania

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InFab Use Agreement  
April 26, 1963

Prepared Under Navy, Bureau of Weapons  
Contract NOW 62-0937-u

January 1, 1963 to March 31, 1963

InFab Use Agreement

April 26, 1963

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Interim Report No. 3

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Universal-Cyclops Steel Corporation

Bridgeville, Pennsylvania

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## ABSTRACT

This report covers the new equipment installation, modification, and maintenance work accomplished in the InFab facility during the period January 1, 1963 - March 31, 1963.



## I. Introduction

As stated in the previous quarterly report, the InFab facility was shut down on December 3, 1962 for new equipment installation and modification. Several major maintenance projects were also initiated during this period. The status of all equipment installation, modification, and maintenance items is reviewed in the body of this report.

Start-up of the facility was initially scheduled for the third week in March, 1963. However, due to the flooding of the Bridgeville Plant, which necessitated the full efforts of the mechanical and electrical departments to be utilized in the clean-up operation, and several minor difficulties in the Ipsen furnace installation, this date has been moved up to April 15, 1963. No further delays are anticipated in the start-up date.

It will be noted that most of the modifications and maintenance items are aimed at improving the purity level of the enclosure atmosphere. This policy will continue until a purity level of 10 ppm total impurities has been reached during operation and the level fully documented.

## II. New Equipment Installation and Modifications

### A. Ipsen Furnace

The installation of the 36" x 96" sheet rolling furnace purchased from Ipsen Industries under Contract 61-0583-u is now 95% complete. Work remains to be accomplished, as outlined below.

#### 1. Roller Drive and Oscillating Mechanism

On the initial check-out of the furnace and controls, it was found that the magnetic clutches were of an insufficient torque rating to drive the furnace rollers. Also, the drive motor (a one-half H. P. two speed reversible unit) developed insufficient torque in the high speed direction. It was also determined that the pneumatic cylinder system supplying the driving force for roller oscillation was under powered. Ipsen Industries is presently working on these problems and they have promised shipment of the necessary components to correct them in time for the scheduled start-up.

#### 2. Furnace Rollers

A complete set of sixteen (16) rollers was included in the initial shipment from Ipsen Industries. However, two of them were broken in installation. In addition, two rollers were held as spares, because of the possibility of roller breakage during the initial heat-up cycle. Hence, there are presently twelve rollers installed in the furnace with the four open slots all at the rear of the furnace. Since the initial work will involve shorter pieces for check-out purposes, this arrangement will be satisfactory. Six additional rollers will be ordered from Ipsen Industries so that we can install the balance of the set and have a stock of spare rollers on hand.

3. Side Guards and Shields

These items will be installed after the previous work listed on the furnace proper has been completed

4. Instrumentation

The three temperature zone controllers supplied for the furnace are calibrated for tungsten versus tungsten + 26% rhenium thermocouples. The thermocouples supplied with the furnace are tungsten plus 5% rhenium versus tungsten +26% rhenium. These instruments require a range change and recalibration to be compatible with the supplied thermocouples.

Ipsen Industries is presently building a rate controller for the temperature control system so that the furnace temperature can be raised or lowered at a specified rate. When this has been completed, Ipsen's instrument specialist will install the rate controller and make the necessary changes to the three zone controllers described in the previous paragraph.

Since all of this work will be done outside of the enclosure, and is strictly a matter of the degree of accuracy within the temperature control system, it will not affect the start-up date of the facility.

5. Except for the previously described items, the installation of the furnace is complete. All of the control wiring and

heating power supplies have been checked out and are working properly. The necessary water and argon piping have been installed and leak checked.

All bearings on the furnace roller drive mechanism have been lubricated with a silicone high temperature grease (DC 44 manufactured by Dow Corning Corporation) to minimize atmosphere contamination.

#### B. Rolling Mill Tables

The modified mill tables have been received from Birdsboro Corporation and installed in the enclosure. All of the necessary control wiring and power supplies to the drive motors have been installed and checked out.

These tables are of much heavier construction than the original table, and are wide enough to accommodate sheet material to the full width of the furnace.

The tables are also mounted on tracks such that they may be moved to the side and clear the mill face. This will enable the mill to be fed by hand, if necessary, when rolling small pieces.

The drive motor on the front table is a 5 H. P. two-speed reversible unit with an integral gear reducer. The arrangement of the drive unit is such that the material entering the mill from the furnace travels at a speed of 300 feet per minute. However, the material moving from the mill to the furnace for reheating travels at a speed of 100 feet per minute.

By present indications, this arrangement is satisfactory, but the table requires an abnormally long time to reach maximum speed in the high speed direction. It may thus be necessary to increase the horsepower rating of this motor if this proves to be a disadvantage.

#### C. Bar Turner Modification

The bar turned has been modified by Birdsboro Corporation to be compatible with the new mill tables. This turner has been re-installed and checked out. Since initial rolling operations will be on sheet material, the actuating rollers were removed from the bar turner and the apparatus set up for sheet rolling.

D. InRoom Control Console

In conjunction with the previous modifications, Ipsen Industries has supplied a small in-room control console which has been installed and checked out. This console allows the in-room operator to operate the front and back tables, the furnace rollers, and the furnace door whenever necessary during loading or rolling. This console is mounted on wheels and connected with the control system via a multi-conductor flexible cable which will allow the console to be moved around the rolling mill area to whatever position is the most convenient.

E. Sheet Rolls

The new double poured sheet rolls with a complete set of chocks and bearings have been received from Birdsboro Corporation. These rolls have been ground, cleaned, and installed in the rolling mill. The old set of sheet rolls has been ground and the bearings reinstalled, so that these rolls can be immediately installed when needed.

F. Hydraulic Piping

The rolling mill hydraulic system piping has been modified to allow independent control of the mill balance cylinders from inside the enclosure. Previously, it was necessary to completely shut down the hydraulic system and bleed the balance piping in the basement to lower the balance cylinders. With the modification to the piping this will not be necessary.

G. Man Air System Modifications

The open loop man air breathing system purchased from Firewel Corporation under Contract NOa 55-006-c has been received and installed.

Two one-inch copper pipe manifolds were installed around the outside periphery of the enclosure and shut off valves were installed at each station. The supply and return lines were passed through the enclosure wall and welded. A quick disconnect fitting was installed at each station for supply and return air lines. The flexible lines between the breathing system station and the suits are made up into twenty-five (25) feet lengths. This length will

allow the in-room operator access to most of the room and equipment by connecting to the appropriate system station. If longer lines are needed, two or more may be connected together. The breathing system stations are located adjacent to the communication system connections.

The cooling and circulating unit has been installed on the roof of the enclosure along with a large accumulator tank which will allow sufficient time for the in-room operator to get out of the room in case of air supply failure.

The noise level of the blower used on the return side of the loop is very objectionable. An exhaust system is presently being fabricated for the outlet side of the blower and will be installed as soon as completed.

#### H. Personnel Suits

The suit enclosures have been modified and returned by David Clark Company. As modified, the suits may be used with either the open loop system or the original back pack system with a minimum amount of changeover required.

The regulator assembly installed on the blouse is very fragile and will not support the weight of the air lines. A makeshift harness is presently being used and as soon as a suitable design has been determined to support the lines, a harness will be made for each suit.

#### I. Communication System

New communication helmets were supplied by David Clark Company along with the suit modifications. These helmets are much sturdier than the original and much more comfortable in that the earphones are not directly into the ear. The earphones in the new helmet are a low impedance type carbon phone, and the microphones are boom mounted carbon-type with an impedance of 50 ohms.

The power amplifier, which was originally used to drive the loudspeakers, is now connected into the system and also drives the earphones with a separate level control for the earphones and loudspeakers. This combination produces excellent volume with very little distortion and low background noise. Presently, this is operating very satisfactory.

J. Gas Sampling System

A gas sampling system has been constructed and installed. This system will permit bottled gas samples to be taken from any position in the room at any time during the operating shift.

These samples will then be sent to Air Products Corporation for analysis. This system will be used to determine specific locations and sources of room contamination. From this information, the necessary corrective action may be determined.

This system is inadequate for our needs and a continuously monitoring system has been requested from the Navy. This additional equipment would enhance the operation of the room and allow for considerable improvement in room atmosphere.

K. Purified Argon Distribution System

The subject piping system has been altered and sufficient valves installed to allow the entire purification plant output to be concentrated in either the impacter or rolling mill areas. This purified argon has also been piped directly into the Ipsen furnace and the impacter coil cart. These modifications will insure that the best atmosphere possible is present in the working area being utilized.

L. Welding Equipment

The welding equipment ordered from Airco Corporation under Contract NOa 55-006-c is expected to be completed and ready for delivery in late April, 1963. The power supply has been received and is presently being used on a small experimental dry box under Contract NOW 63-0043-c.

The feed-through for the control circuit and power supply is presently being fabricated so that installation of the stake seamer and rotary positioner will interfere as little as possible with other operations in the enclosure.

M. Coil Cart Cover

A sliding coil cart cover has been fabricated and installed in the base of the impacter. This cover is operated by a pneumatic

cylinder-supplied by the in-room argon compressor and remotely controlled from the impacter control console.

This cover will prevent damage to the induction heating coils in case of broken nipples or dropped billets.

N. Man Lock Purge System

The piping on the man lock has been altered to allow the lock to be purged from the bottom with argon from the in-room compressor receiver. This modification utilizes the solenoid valves and timers originally intended for the nitrogen purge system. Also, arrangements have been made which will allow the in-room operator to purge the areas of the suit between the impervious layer, the protective asbestos covering and the inside of the boats. This purging will be done while the operator is waiting for the lock purge to complete its cycle. This modification will reduce the contamination introduced into the room upon entry of the in-room operators.

O. Instrument Air System

The instrument air system is now supplied from the same filtered source as the man-air breathing system. This air is picked up between the accumulator and the cooling unit on the man air system immediately after the primary filter. An additional filter has been installed in the instrument air system. All filters have by-pass lines installed so that filter elements can be changed without interrupting operations.

P. Distilled Water System

After consultation with several water treatment specialists and Air Products, Inc., a pressure pot feeder was installed in the distilled water system to feed a controlled quantity of sodium dichromate into the system. This additive is intended to prevent corrosion in the Nash Hytor Argon compressor water system. A water filter was also installed to remove any sediment or corrosion products from the flow.

The piping was then changed to allow the still to be operated continuously. With this modification, the quality of the distilled water should be definitely improved and samples can be taken to

check the purity of the distilled water at regular intervals.

Since several months of continuous operation will be required to evaluate the results of this modification, this item will be kept open and results will be reported in subsequent quarterly reports.

Q. Control Wiring

During the installation of the Ipsen furnace and the modified mill tables, it was necessary to change much of the control wiring and move the feed-through to allow room to move the mill tables aside. In view of the trouble previously encountered with the original mineral insulated wire, all of this wiring that was affected by the new modification, was removed and the original feed-throughs were plugged and welded. All the new wiring was done with flexible multi-conductor cable. New feed-throughs were constructed and installed utilizing multi-conductor plugs. These plugs have the conductors vulcanized into the plug base. The base is gasketed to a plate welded into the enclosure wall. The plug is then wired into a junction box on each side of the wall so that a defective plug may be replaced in a few minutes.

IV. Maintenance Argon Purification System

A. Nitrogen Compressors

All of the changes and maintenance items recommended by Ingersoll Rand and Air Products, Inc. listed in the last quarterly report have been completed. The packing and cylinder lubricant was changed to Cellulube 300. This is a phosphate ester, synthetic, fire-resistant lubricant designed to eliminate the fire hazard involved in operating at high discharge temperatures and to lessen the carbon build-up in the valve areas.

In addition, since the facility was to be shut-down for a considerable period of time, compressor "B" was completely overhauled. A new piston rod was installed along with new rings in the first and second stages and a new piston and liner assembly in the third stage. All valves were cleaned and lapped. This compressor is now in new condition and should give good service in the future.



Compressor "A" was torn down to repair an oil leak between the first and second stages. While the compressor was dismantled, new second and third stage rings were installed. All the valves were cleaned and lapped. This compressor is now in very good condition also.

B. Nash Hytor Argon Compressors

The shaft packing in these compressors was changed and the compressor enclosures cleaned. This work along with the modifications to the distilled water system listed in Section II-M of this report should insure trouble-free operation of these units in the future.

C. Low Level Freon Unit

During the last shutdown procedure, a knock was detected in the Brunner compressor on the low level freon unit. Heagy Refrigeration Company was called in and repaired the unit. New crankshaft main bearings were required along with a new crankcase oil pump. The knock was caused by the main bearing turning inside the crankcase housing due to an insufficient retainer notch in the bearing itself. This condition in turn damaged the oil pump. The new main bearing is designed to prevent the recurrence of this condition.

In addition, a new cartridge was installed in the filter, a new crankcase heater was installed, and all the unloader valves checked. The system was charged with refrigerant and test run.

D. Instrumentation

An instrument specialist was brought in from Air Products, Inc. and the entire instrument system overhauled and checked out. New calibration gases were purchased which permit all the instruments to be calibrated at both ends of their respective ranges. In addition, the instruments can be calibrated at the desired operating range of room purity level.

The itemized listing of instrument repairs has not been received from Air Products, Inc. as yet. This will be included in the next quarterly report. However, the instruments are all in good condition now and this work, along with the modifications to the

instrument air supply listed in Section II - L. should aid in improving the purity levels in the InFab enclosure.

E. Supporting Equipment

All other supporting equipment in the purification system has been frequently test run and inspected to insure as trouble-free a start-up as possible.

IV. Maintenance InRoom Equipment

A. Impacter and Related Items

1. Impacter and Manipulator Oil Leakage

All of the oil leaks have been repaired by replacing all defective packing and fittings. The machine has been completely cleaned of oil and grease. After consultation with Dow Corning Corporation, a silicon fluid was purchased to be used in the lubrication. These lubricators feed the slides on the impacter and manipulator. Since this is all open lubrication, a certain amount of lubricant will always be exposed to the atmosphere. This silicon fluid has a lubricity comparable to the oils previously used but the volatility is approximately one tenth of the volatility of the oil. This new lubricant should definitely improve the atmosphere purity in the impacter area.

2. Electrostatic Precipitation

A representative of the manufacturer was sent in by the supplier and recommended that a heavier resistor be installed in the A. C. supply line, and higher rated fuses of the "slow blow" type be used in the system. These changes were made as recommended. The precipitators were wired so that they will now operate independently of the lubricators, since the manufacturer recommended that these units be operated full time when they are in use. Final evaluation on this item will be included in the next quarterly report.

3. Coil Cart

The damaged top on the eight inch diameter heating coil was removed and modification made to the top. If this modified

coil proves satisfactory, the other coils will be similarly modified.

B. Rolling Mill and Related Items

1. Mill Lubrication System

The repair parts for the lubricator pump have been received and installed. The pump has been run and leak checked and is now satisfactory.

2. Pinion Stand Oil Seal

The clipper seal on the drive end of the mill pinion stand has been replaced and leak tested.

C. InRoom Argon Compressor

All defective fittings on the in-room argon compressor were replaced and the compressor was completely cleaned. The lubricator was removed and cleaned and replaced. The lubricant was changed to a fluoro-silicon fluid to minimize atmosphere contamination from the compressor lubricant. This fluid (Dow Corning FS1265) has a lubricity comparable to the oil used previously but has a vapor pressure of less than .1 mm. Hg at 300° F.

V. Future Work

As previously stated, start-up is scheduled for April 15, 1963. Initial work will be on forging operations under contracts. AF33(657)-8495 and NOas 59-6142-c.

The Ipsen furnace installation will be completed during the first two weeks of April and during the start-up period.

A series of gas samples will be taken and analyzed to determine exact purity levels at various locations in the room during operation. This data will also be used to evaluate the modifications made during the past quarter.

The 36" stake seamer and rotary positioner will be set up outside the room and checked out. When the check out is completed, the equipment will be moved into the room and connected.