B.F.GOODRICH CHEMICAL COMPANY

PROCESS DESIGN MANUAL

AVON LAKE GENERAL CHEMICAL PLANT

1966 RESIN EXPANSION

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April, 1967 11

NGC35849

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INTRODUCTION

The growth of the market for blow molded PVC containers requiring transparent compounds has resulted in an increased need for Geon resins. The 1966 Avon Lake Resin Expansion was designed to produce the types of resin needed to manufacture compound in the new compounding facilities.

Short-range needs for increased sales of Geon resins and compounds, necessitated the expansion of existing facilities. Since the market for transparent compounds is largely in the mid-west, the Avon Lake plant was selected as the location for the new PVC and compound expansion. Also, an additional compound line could be installed more readily in the new compound building already being designed.

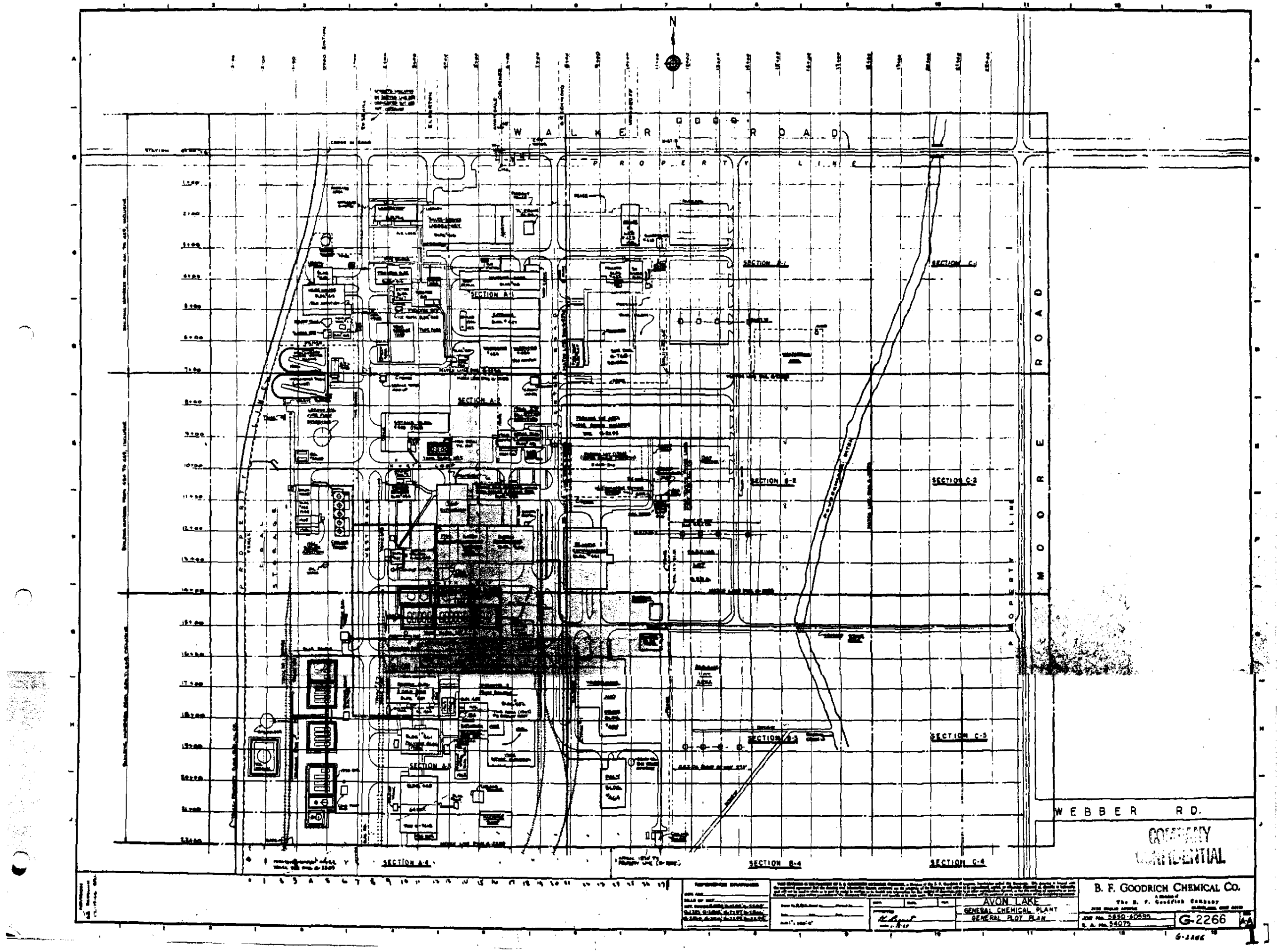
The new resin expansion area was designed to produce 72,000,000 pounds of general purpose pearl resin per year. The majority of the resin produced in this area will be used to manufacture compound. The polymerization building has been designed for easy expansion that would more than double the present 16 polymerizer arrangement. Also, the building equipment has been designed for ready conversion of a limited number of the polymerizers to co-polymer resin types.

One of the sixteen polymerizers is a 5200 gallon vessel, making this the first B.F.Goodrich plant to use a vessel of this size in PVC production. All of the polymerizers are equipped with a water dispersing device on the top head, to help cool the unjacketed portion of the vessel. The new production area is designed to produce three different pearl resins simultaneously, with the amounts of each type in production depending upon a variety of equipment arrangements that are possible due to the complete flexibility designed into the entire system. Also, the new PVC production area contains an unusual "low" pressure recovery system making use of refrigerated water supplied by an ice reserve unit to condense the desuperheated VCl monomer.

This facility will be a key to securing a dominant position in a new compound market, with the resin producing area alone costing in excess of 7,000,000 dollars. The design manual has been prepared to assist in the start-up and initial operations.

of the new PVC production area. The manual contains all of the important information regarding the design of the resin producing area. Complete and detailed information is available in the Process Engineering files under process design job PD-513.

J. W. Goetsch



DESIGN CONSIDERATIONS

General

The tank farm flowsheet covers the facilities for storage and transfer of vinyl chloride monomer.

Vinyl Chloride Storage

An existing sphere (TK-15B-1) is used for the storage of VCl monomer. TK-15B-1 is a 43'6" diameter sphere with a capacity of 322,400 gallons of VCl and rated at 100 psig. All nozzles, with the exception of the relief lines, are equipped with excess flow valves which will close in case of line rupture. The two 6" outlet nozzles used for VCl transfer to the pump suction are equipped with MGM No. W166:P Excess Flow Check Valves which will flow 410 GPM of VCl each. The closing flow is approximately 485 GPM.

One 6" suction line will be satisfactory for normal operation at 400 GPM and it should be possible to pump liquid from the sphere to within 2 - 3 feet of the bottom; however, when low static head conditions exist, both 6" lines will be needed for transferring from the sphere.

Vinyl Chloride Charging Pump

The vinyl chloride charging pump (PU-11B-1) is a Union Duplex Size 18x11x18 steam pump rated at 400 GPM. The pump is equipped with a pressure control system on the steam supply which is operated by a pressure sensor in the discharge line of the pump. The pump will maintain a constant line pressure to the charge meters ("C" Flowsheet) and is designed for continuous operation.

Shutdown of the pump is accomplished by closing the manual valves on the steam supply line to the pump. A ½" bleed line has been installed from the discharge of the pump to the suction side of the pump. The valve in this

line should be kept open during normal operations allowing the pump to run at a very slow rate, reducing leakage problems due to seals drying out and pressure buildup caused by steam leakage through the control valve (V-D-03-1).

Surge Tanks

Two 20 gallon, steam traced surge tanks (TK-16 & 173-1) are located in the discharge line of PU-11B-1 to reduce the pressure surges common to piston pump operation. VCl is vaporized in the steam traced upper half of the surge tanks, providing a vapor cushion to absorb the pressure pulsations.

Transfer Lines

The 6" transfer line to B-464 is sectionalized to provide cut-off points should a line rupture occur between the pump and the process areas. Relief valves have been installed in the sections of the lines between the sectionalizing valves giving protection against hydrostatic pressure buildup. Both the suction and discharge lines are equipped with relief valves for protection from hydrostatic pressure problems.

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"C" FLOWSHEET

DESIGN CONSIDERATIONS

General

"C" Flowsheet includes the polymerizer charging system, shortstop addition, meter calibration and recovered VCl charging system, high pressure seal water system, vacuum system, hot DM water storage, high pressure water polymerizer cleaning, and the nitrogen booster compressor package unit.

Three separate charging systems have been provided for the three production lines with two VCl and hot DM water metering stations. The two metering stations are piped to provide charging from either meter station to any of the three charging areas. Each charging system or area has provisions for catalyst solution charging, emulsifier solution make-up and charging, buffer solution make-up and charging, and a shortstop addition system.

Polymerizer Charging System

The polymerizer charging for the Avon Lake 1966 Resin Expansion can be accomplished in one of two ways. The first method utilizes the latest charging technique as originated for the Henry PVC Plant with the polys charged as follows:

1. Poly Evacuation

Two sets of vacuum jets (VJ-1C & 2C) are provided for the evacuation of PLY-1D to 16D, TK-1D to 6D and TK-19C & 25C. The jets are two stage condensing ejector units with barometric inter-condensers. Each unit is sized to evacuate 700 cu.ft. of air from 30 in. Hg. to 2 in. Hg. in approximately 20 minutes. A 50 gallon tank (TK-24C) is supplied to seal the barometric legs. Pull the maximum vacuum possible with the jets, test for leaks and proceed with charging. It will

be necessary to add a small amount of water initially to the polymerizer before pulling the vacuum to aid in sweeping the residual oxygen from the vessel. It may be possible to overcome the residual oxygen problem by pulling a vacuum twice and breaking the first vacuum with water. Note: Do not use steam injection to break vacuum. If too much steam was injected, the temperature difference between the jacket and inside of the vessel would cause the glass lining to spall.

2. Fresh VCl Charging

Charge the recipe amount of fresh VCl (less the recovered VCl) from TK-1/3-1 using PU-113-1 as previously described in the "B-1" flow-sheet writeup. The flow is measured by one of two meters (MV-1 or 2C) depending on which charging area and polymerizer is used. It should be noted that both metering stations can be used simultaneously since the charging pump is rated at a maximum flow of 400 GPM and each VCl charge meter is set for a maximum charging rate of 200 GPM. The VCl should be routed through the catalyst charge bottle (TK-16, 17 or 18C) to which the catalyst solution has been added, sweeping the solution into the polymerizer. The charging meters are described in more detail in the "Instrumentation" section of the manual.

3. Recovered VCl Charging

Recovered VCl will be charged from TK-19 or 25C using the automatic system described in the "Instrument" section (Sec. IV) of the manual. The recovered VCl will be transferred from TK-1 or 2F using PU-1 or 2F, into the recovered VCl tanks at a maximum rate of 130 GPM. The recovered VCl will pass through one of filters (FIL-1 & 2/TK-19 & 25C) before entering the charging tank to eliminate possible contamination from polymerized VCl.

Recovered VCl is pumped from TK-19 or 25C when the discharge button is pushed using PU-6 or 7C at a rate of 100 GPM. It is suggested recovered VCl be recharged incrementally. Therefore, each charge would contain some fresh vinyl chloride and some recovered material. The recovered vinyl chloride will be charged through the catalyst charge bottles as previously outlined for fresh monomer.

4. Hot DM Water Storage and Charging

Charge the required amount of hot (120°F to 170°F) D.M. water through the same catalyst charging bottle and common header into the poly. The water thus flushes out all traces of VCl and catalyst. The hot DM water is stored in a 42,000 gal., carbon steel, epoxy-lined, API type tank (TK-20C). The tank is provided with an emergency vent (MH-SP-1/TK-20C), is insulated and is equipped with an internal heating coil (HE-1/TK-20C) for cold weather operation. Cold DM water is heated to the highest required temperature (170°F) before being added to the tank by HE-1C.

The hot DM water is transferred to the charging station by PU-1 & 2C at a rate of 200 GPM. Both pumps will be used simultaneously, since charging can be carried out in two separate areas at one time. Each pump can spare the other, but with an increase in charging time when only one pump is operating. Cold DM water can be added to the pump suction to control the temperature of the hot charge DM water. The amount added will be controlled by a temperature controller (T-CI-1/PU-1C) enabling the charging of hot DM water at any intermediate temperature required at either of the three charging areas.

During the same time the hot DM water is being added, the emulsifier and buffer solutions will be injected into the charging line. The emulsifier solution will be made up in solution tanks TK-1 to 6C. Two tanks

per charging area are provided, so a batch of solution can be made up in one tank while the other is being used in the charging operation. The make-up of the calcium acetate buffer solution requires little time, therefore, only one make-up tank is provided per charge area (TK-10 to 12C).

The make-up tanks for both solutions are 300 gal. stainless steel, sloped bottomed tanks containing a coil for heating and cooling. The tanks will be equipped with center agitation. The buffer make-up tank can be used for other types of emulsifiers if more than one type is needed. If non-soluble type buffers are required, they will have to be added "in-situ" similar to the Henry PVC plant operation.

The solutions from the emulsifier and buffer tanks drain by gravity into the charge bottles (TK-7 to 9C or TK-13 to 15C). The charge bottles are 40 gallon, stainless steel tanks rated at 250 psig at 168°F and supported from load cells. The bottles will be pressured with 200 psig nitrogen and the correct weight of solution pressured into the hot DM water being charged into the polymerizer. See the "Instrument" portion (Sec. IV) of the manual for details of the weigh system operation.

After the hot water and emulsifiers are added the instrument should be set for the desired polymerization temperature. Actually, the contents of the vessel should be close to polymerization temperature upon completion of charging.

Some of the advantages of the proposed charging method are:

1. The VCl and the catalyst become intimately mixed before the polymerization begins.
2. At the completion of the charging procedure the lines are all filled with water.
3. The proposed system using predissolved emulsifiers lends itself to automatic sequential charging.

The polys can also be charged using the "time honored" method as follows:

1. Charge the required amount of hot water through the [illegible] and hot water charging line to the open manhead. A filling hose connection is provided for each two polys if it becomes necessary to fill the polys without the water passing through the meters.
2. Add the recipe amounts of emulsifiers and agitate.
3. Close the manhead and pull the desired vacuum.
4. Charge the recipe amount of VCl through the charging bottle and charging header. It might be necessary to withhold some of the initial charge water and add it after the VCl to flush out the charge bottle and lines. If caprylyl peroxide or IPP was used in the catalyst charging bottle, then a water flush is mandatory.

The VCl charging pumps (PU-11B-1 and PU-6 or 7C) have a discharge pressure of 249 psig and 200 psig respectively, while the water charging pumps (PU-1C and PU-2C) have a discharge pressure of 260 psig. Therefore, all the charging pumps are able to pump into a poly under pressure even at the maximum charging water temperature of 170°F.

D.M. Water for Seal Flush and Water Injection System

Hot DM water for the polymerizer agitator seal flush and water injection system will be supplied by high pressure pumps, PU-3 & 4C. The pumps are rated for 32 GPM each, giving additional capacity for the proposed future full poly operation. A heat exchanger (HE-1/PU-3 & 4C) is provided in the recycle line to remove the heat generated by the pumps when the full flow of water is not being utilized.

In case of power failure, automatic valves close in the polymerizer water injection supply header. DM water is supplied to the agitator seal flush header from the pressure tank (TK-21C) using nitrogen pressure from a high

pressure cylinder back-up system. TK-21C is a 200 gallon, stainless steel vessel rated at 350 psig and F.V. at 200°F.

Short Stop Addition

Three bottles (TK-23, 26 & 27C) are provided for the addition of liquid short stop , one bottle for each charging area. The separate bottle for each charging system will enable the use of different types of short stop in any one system. TK-23, 26 & 26C are 15 gallon, stainless steel tanks rated at 325 psig at 100°F. The short stop solution is added manually to the bottle and pressured into the polymerizer with nitrogen. A sight glass in the addition line at the polymerizer or a drop in pressure at the bottle will enable the operator to determine when all the solution has been added to the polymerizer. Extreme care must be exercised at completion of the short stop addition to avoid excessive addition of nitrogen to the polymerizer contents.

High Pressure Poly Cleaning System

A high pressure water pump (PU-5C) has been provided for polymerizer cleaning. The pump is rated at 45 GPM at 6000 psig discharge pressure. A complete description of the controls for the high pressure cleaning pump system is provided in the "Instrument" area (Sec. IV) of the manual. Two manual poly cleaning lances will be supplied.

Water headers have been supplied for the future use of the Sellers Rotor Jet cleaning device. The Sellers nozzles require up to 45 GPM of water at a maximum pressure of 6000 psig. A unit is presently being designed for use in the polymerizer area of the new expansion.

Meter Calibration

The VCl and DM water charging meters will be calibrated by running VCl or water through the meters into TK-19 or 25C. The contents of the tank can then be pumped out to a polymerizer. TK-19 & 25C are 1000 gallon, stainless steel tanks rated at 250 psig and full vacuum at 168°F. These tanks serve in a dual role as calibration and recovered VCl charging tanks.

Nitrogen Compressor Unit

High pressure nitrogen at various levels (200 & 300 psig) is needed for pressurizing poly agitator drive heat exchangers, emulsifier charge bottles, short stop charge bottles, etc. The high pressure nitrogen is supplied from a Gardner-Denver compressor package unit rated at 162 SCFM and 400 psig discharge pressure. The compressor discharge will be regulated to provide a pressure of 310-325 psig. A pressure reducing station (V-PA-1C) is provided to lower the pressure to 200 psig.

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Design Considerations

General

Flowsheet "D" covers the polymerization and blowdown areas. Included on the flowsheet, along with layouts for a typical polymerizer and blowdown tank arrangement, are schematic diagrams of the various headers at the top and bottom of the polymerizers and blowdown tanks. All of the polymerizers are glass lined, carbon steel vessels with bottom entering agitators. PLYS-1 to 15D are 4300 gallon vessels -- PLY-16D is a 5200 gallon vessel. All the polys are interconnected so that various sized groups of three can be used, with the number of polys per group dependent on the schedule, slurry inventory, dryer loads, maintenance, etc.

The two end groups of polys (PLY-1 to 4D & 13 to 16D) are connected to one 9000 gallon blend tank for each four polys. The other eight polys are connected in pairs to four 6000 gallon blend tanks. All of the blowdown tanks are interconnected so that they can be grouped with the correct polys and blend tanks, maintaining the three separate production areas throughout.

Charging Header

The polymerizers are serviced with one common 4" charging header equipped with 3-way valves at each polymerizer. The header has block valves located between each group of two or four polys (as dictated by the blowdown tank arrangement described above), so that it can be divided into three separate sections for charging from the three charge areas. The 3-way valves in the charge headers are Continental teflon lined valves with a port arrangement that enables the liquid to flow through the valve or into the poly from either direction.

Polymerization

1. Polymerizers - 1 to 15D.

The polys in this group are 4300 gallon, glass lined, jacketed vessels rated at 300 psig and F.V. at 300°F. The vessels are equipped with Philadelphia Gear, model PSE-2M, size 14-400, bottom entering drive units (DRV-1/PLY-1 to 15D). The drive units will have a 4" stainless steel shaft to which is attached one 48" diameter, 3-blade retreat curve impeller. Agitation speed is designed for 150 rpm. Each drive unit is equipped with a Pfaudler oil pressure-cooler unit (HE-1/PLY-1 to 15D). Each poly contains two 9" wide, water cooled, beaver tail baffles set at 50° to the wall, angled toward the oncoming flow.

Each poly is equipped with a 3" manual vent line running directly to the roof. Abnormal charges, in which the pressure builds up too rapidly, can be vented through this line. In addition to the manual vent line, each poly has a double insert type rupture disc assembly. Details of the rupture disc assembly along with a copy of the drawing for the assembly are included in the Safety Design (Sect V) area of the manual.

The poly manheads are a Lenape quick opening type using only an O-ring gasket for sealing at closure. The manheads have a design pressure of 300 psig or full vacuum at 300°F.

The polys are equipped with ball valves on both the top and bottom of the vessel with the exception of the charging header. The charging line to the poly has a plug type valve to help eliminate any buildup that might occur in the pockets of ball valves. The ball valve on the poly discharge line is a 4" Pacific "full flow" type.

Any lines entering or leaving the polys that may contain VCl or other hazardous vapors have double valves with a special venting arrangement (V-SP-2-6/PLY 1-15D). The vent or inspection plate on the special fitting must be open to the room whenever a man is inside the poly.

A poly cleaning alarm system is provided for each poly. A detailed discussion of the system is included in the Safety Design (Sect. V) area of the manual. Before the poly can be safely entered, it must be suitably aired out with the ventilating system (BL-1D). One ventilating hose station located at the floor level is provided for each polymerizer.

Each poly is equipped with a continuous water injection system. The DM water is supplied to an injection header at about 300 psig by pumps PU-3C & 4C. These pumps also supply water for bottom agitator seal flushing through a separate header system. In case of a power failure, an automatic valve closes in the water injection header, restricting the limited supply of water in the emergency pressure tank system (TK-21C) for use with agitator seal flushing header. The rate of water injection is controlled with individual rotameters at the poly (F-C1-1C/PLY-1 to 15D). The block valve between the rotameters and the poly must be closed before the charge is dropped so the small rotameter valves will not be subjected to a 300 pound pressure drop. The D.M. injection water is added to the polymerizer through a special fitting mounted just below the rupture disc flange. The fitting is designed to spray the water onto the bottom of the disc, helping to keep the rupture disc opening free of buildup (See Safety Design, Section V).

The top head of the polymerizer is not jacketed. In order to take advantage of the extra heat transfer area during water injection and future full poly operation, a special cooling water (WI-C) spray ring assembly has been installed on each polymerizer. The polys are supplied with gutters to collect the cooling water. The water will drain by gravity from the gutters into a tank (TK-7D) and be pumped (PU-5D) into the cooling water return system.

2. Polymerizer - 16D.

Poly 16D is a 5200 gallon, glass lined, jacketed reactor rated at 300 psig and F.V. at 300°F. The vessel is equipped with a Philadelphia Gear, model PSE-2M, size 17-400, bottom entering, drive assembly with 4" diameter stainless steel shaft projecting 29½" from the face of the mounting flange and mounting one 54" diameter, glass-coated, retreat curve impeller. The design shaft speed of 133 rpm is obtained by a combination of a spiral bevel gear reducer and a V-belt drive.

Because of a lack of experience with agitation problems in a vessel of this size, an alternate agitation system has been supplied. The alternate system consists of a spare 4" diameter shaft projecting 96½" from the face of the mounting flange, equipped with 2-50" diameter, glass coated, retreat curve impellers. The impellers are located on centerlines 93 and 26" from the face of the mounting flange. An extra set of sheaves is provided to operate the alternate agitation system at 125 rpm.

The top head, bottom head and shell openings are the same as those on the 4300 gallon reactors (PLY-1 to 15D). The jacket openings are the same except the 5200 gallon vessel has five agitating nozzles(only four

are provided on the 4300 gallon reactor) and the jacket water outlet is 6" instead of 4". More cooling water will be needed on the 5200 gallon vessel, hence five nozzles are provided so approximately the same pressure drop per nozzle will be obtained. In this way, approximately the same liquid film transfer coefficient will be obtained in both poly sizes.

The remaining polymerizer equipment is the same for the 5200 gallon vessel as it is on the 4300 gallon reactors. The polymerizer instrument controls for all the polymerizers are described in detail in the Instrument (Sect. IV) area of the manual .

Blowdown

As described earlier, there are two sizes of blowdown tanks - 9000 gallon tanks (TK-1 & 6D) with four polys per tank and 6000 gallon tanks (TK-2 to 5D) with two polys per tank. Both the 6000 and 9000 gallon tanks are stainless steel clad, vertical vessels designed for an allowable working pressure of 196 psig and full vacuum at 300°F.

The 6000 gallon tanks are equipped with Chemineer Model MNP-50-326, top entering, agitator drive units. The drive units have a 2-3/4" shaft mounted with one 40" diameter, 4 pitched-blade turbine operating at 68 rpm.

The 9000 gallon tanks are equipped with Chemineer Model MNP-75-246, top entering, agitator drive units. The drive units have a 3-1/2" shaft mounted with two 42" diameter, 4 pitched-blade turbines, the bottom turbines having a stablizing ring. The shaft speed is 68 rpm. All blowdown tank drive units are equipped with Pfaudler oil pressure - convection cooling units (HE-1/TK-1 to 6D).

Each blowdown tank is provided with steam lines for live steam sparging. When low conversion resins are produced, the slurry will be steam sparged (V-D-1/TK-1 to 6D) in the blowdown tanks to remove all the vinyl chloride. The steam will automatically be shut off (V-SP-1/TK-1 to 6D) when the desired slurry temperature is reached and an alarm will sound. The blowdown tank temperatures of the six tanks are recorded

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individual recorder (T-R-1/TK-1D). A detailed description of the operation of the control system is given in the Instrument section of the manual.

At the completion of recovery, the slurry is pumped from the blowdown tanks to the blowdown pumps PU-1D, 2D and 3D. A portable spare pump (PU-4D) is provided that can be substituted for either of the three pumps through a series of hose connections. The pumps are designed to pump out the tanks at a rate of 225 GPM with a suction pressure of 10" Hg. Strainers (STN-1/PU-1 to 3D) containing 4 mesh wire screen are provided on the suction side of the pumps to remove any large lumps from the slurry.

In order to reduce air buildup in the recovery system, it is desirable to pump out the blowdown tanks without breaking the vacuum with air. The pumps are designed to pump out with a negative suction pressure; however, if it becomes necessary to break the vacuum to some degree, steam lines have been provided at the top of each blowdown tank for this purpose.

Recovery

Each pump is equipped with a "Hi Pressure" recovery line and a "Poly" recovery line. The "Hi Pressure" recovery lines are stainless steel and the "Poly" recovery lines are carbon steel. Generally, recovery will begin after the charges have been dropped to the blowdown tanks. Monomer vapor above 30 psig is recovered through the empty poly using the poly as a primary foam trap. After completion of the "Hi Pressure" phase, the bottom valve of the poly will be closed. Recovery of the vapors in the polymerizer will be accomplished through the "Poly" recovery lines.

At the same time, the recovery of the charge in the blowdown tank will be completed through the recovery line from the blowdown tank. Complete details of the entire operation are shown on the recovery flowsheets (F and FA) and explained in the flowsheet write-up.

"E" FLOWSHEET

DESIGN CONSIDERATIONS

Slurry Blending

Six blend tanks (TK-1E to 6E) are provided - two for each production line. The tanks have a flat, sloping bottom with a capacity of 19,600 gal. each. The tanks are constructed of T-304 stainless steel and designed for atmospheric pressure. Each tank is equipped with a side-entering Chemineer Model SAG-200-342, drive assembly located at the bottom of the tank. The shaft speed of the 24" diameter, square pitch marine propeller is 420 RPM. The units are supplied with a packing gland, lantern ring and flush chamber. It is important to keep flush water on at all times using the rotameters provided (F-CI-1/TK-1E to 6E) to maintain the proper flow. In case of a power failure, air can be injected into the bottom of the tank to assist in agitation.

Basket strainers (STN-1/TK-1E to 6E) containing 4 mesh screen wire are provided to remove any large lumps from the slurry. These baskets will have to be checked regularly and cleaned as needed. The slurry circulating return line is designed so that the slurry stream returning from the dryers does not exit into the basket strainer, thus reducing considerably the problem of overflowing strainer baskets.

To provide ventilation and minimize the chance for VCl vapors to accumulate, each tank is equipped with a fan (BL-1/TK-1E to 6E). Each fan is designed to pull 1660 SCFM fan at a 5" W.G. static pressure. Each tank is provided with an air ventilation inlet so a vacuum will not be pulled on the tank. A filter (FIL-1/TK-1E to 6E) is installed on each ventilation inlet to prevent contamination of the slurry.

Separate inlet lines are provided for slurry flow from the blowdown tanks, poly wash down, and the dryer recirculation system. The dryer recirculation lines are manifolded to permit slurry to be recirculated from either dryer to the proper tank.

Four slurry pumps (PU-1E to 4E) are supplied to feed the three dryers. Only three will be used at a time and the fourth is a spare. The spare pump is portable and can quickly replace either of the three slurry pumps through a system of hoses and quick-connect fittings. The pump discharge lines are manifolded to enable the use of either dryer with any of the blends tanks.

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Design Considerations

General

The monomer recovery system was designed to handle the recovery from 32 pearl charges per day with 3500 pounds of monomer to be recovered from each charge. This design is based on 16 - 4300 gallon polys converting 75% of the charged monomer to polymer with a 12 hour turnaround cycle.

Recovery time will be approximately 30 minutes per charge. Recovery is accomplished in three levels - "hi pressure", "intermediate pressure" and "low pressure."

The pressure of the recovery vapors determines the recovery level. All recovery vapors above 30 psig are considered "high pressure" recovery.

Recovery vapors 30 psig down to 0 psig are called "intermediate pressure" and vapors from 0 psig to 3.4 psia are "low pressure" recovery.

Refrigerated water at 35°F is used to condense the desuperheated monomer at 25 psig and 55°F to 45°F in a shell and tube condenser. The vapors which are not condensed at 45°F and 25 psig are compressed and condensed at 85 psig. Any non-condensables are vented to the atmosphere.

The refrigerated water is supplied by an ice reserve unit.

Description of the Recovery System :

"Hi Pressure" Recovery thru the Polys

Monomer vapor (above 30 psig) is recovered through the empty poly after the charge has been blown down using the poly as a foam trap. The monomer from the polymerizer passes through a 500 gallon centrifugal knock-out separator, SE-6F (common to all polys) through a 10,000 gallon surge tank (TK-7F) which serves to disengage liquid or solid carry-over and dampen the pressure fluctuations during recovery. The vapors are then passed through a filter to keep the recovery cooler-condensers clean. After the filter (FIL-5F or 6F) the vapors pass through a control valve (V-D-2/CN-1F) such that the total recovery vapors to the desuperheater

(HE-2F) and monomer vapor condenser (CN-1F or 2F) will not exceed the capacity of the condenser. The total vapor flow is measured across an orifice (OR-1/CN-1F) and corrected for temperature and pressure. The vapors then flow through HE-2F where they are cooled to 55°F, to CN-1F or 2F, to be condensed then to DE-1F where the water settles out and is drained periodically to TK-3F. The recovered liquid VCl flows by gravity from DE-1F to the recovered VCl storage tanks TK-1F (or 2F) outside the building.

When the recovery vapor pressure falls to 30-35 psig, the poly is isolated and the system is switched from "high pressure" recovery to "intermediate pressure" recovery by opening the blowdown tank recovery valve. The isolated poly is recovered separately but simultaneously through CM-3F or 4F.

"Intermediate Pressure" Recovery from the Blowdown Tanks

The monomer vapor, 30 psig to 0 psig, from the blowdown tank passes through one of three 500 gallon centrifugal knock-out separators (SE-1F-3F). The recovery vapors from these separators are combined and passed through a high-efficiency water-sprayed separator (SE-6F), a filter (FIL-3F or 4F) and then to the compressors, CM-2F (or 4F) where the recovered monomer is compressed to 30 psig and delivered to the desuperheater-condensing system.

"Low Pressure" Recovery

The recovery vapors (Opsig down to 3.4 psia) are treated the same as intermediate pressure recovery except that after the 500 gallon separator, the water spray separator and the filter, the VCl vapors pass to the vacuum pump, CM-1F (or 3F) to be compressed to 0 psig, to the compressor CM-2F (or 4F) to be compressed to 30 psig and then to the desuperheater-condensing system.

Poly Recovery

"Hi pressure" recovery from the poly is for emergencies only and is the same as charge recovery but direct from the poly with a full or partial charge in the poly. "Intermediate and low" pressure recovery of the poly is effected from the

"empty" poly after it is isolated at 30-35 psig. The poly is recovered the same as the charge in the blowdown tank except without a 500 gallon separator or a water spray separator. The vapor from the empty poly passes directly to a filter, (FIL-1F or 2F) and to a compressor, CM-4F, for "intermediate pressure" recovery or to a vacuum pump, CM-3F, and a compressor CM-4F, for "low pressure" recovery. After compression to 30 psig the poly recovery vapors are combined with the blow down tank or "charge" recovery vapors from compressor CM-2F and piped to the condensing system, etc.

Vacuum Pump-Compressor Section

The following describes either poly or charge recovery.

The "intermediate pressure" recovery uses a liquid ring or liquid piston compressor and its associated equipment. The compressor (using water as the compressant) is a "water sealed," rotary compressor which is held in a by-passed (V-SP-1/CM-2F or 4F open), unloaded (V-SP-4/CM-2F or 4F open) running status when not being used. When the recovery vapors are switched to the compressor, the by-pass line around the compressor is closed (V-SP-1/CM-2F also V-SP-4/CM-2F) and the seal water addition is increased (V-SP-3/CM-2F open) to form a water ring or seal in the compressor. Some seal water (5 GPM) is continually pumped to the compressor even during the unloaded part of the cycle.

The pressure at the suction of the recovery compressor will range from a high of 30 psig to a minimum of about 0 to -2 psig during "intermediate pressure" recovery. The recovery vapors are compressed to 30 psig and piped upstream of the orifice (OR-1/CN-1F), but downstream of the throttling valve on the high pressure recovery system.

This means that recovery vapors from the compressors will be sent directly to the desuperheater. Only the high pressure recovery system flow will be throttled in the event that the total capacity of the recovery monomer condenser is exceeded. This throttling should occur only very rarely and when it does, will probably last less than one minute.

The suction pressure to recovery compressor (2nd stage) is not allowed to drop below -2 psig during recovery. This minimum suction pressure is maintained by recycling recovery monomer vapor from the compressor discharge as needed (via V-D-1/CM-2F or 4F).

When the recovery monomer vapor pressure has been reduced to about 0 to -2 psig at the separator, "low pressure" recovery is started.

The low pressure recovery system includes a vacuum pump connected in series with a compressor and its associated equipment. The vacuum pump is also a water-sealed rotary compressor, but of a different design and capacity than the compressor. During the "intermediate pressure" recovery the recovery vapors by-pass the vacuum pump which is maintained in the by-passed, (V-SP-2/CM-1F or 3F open), unloaded, running status until required.

When the system is switched to two stage operation of "low pressure" recovery, the by-pass around the vacuum pump is closed and the seal water addition is increased (V-SP-4/CM-1F open) to form a liquid seal in the pump. The seal water discharged with the compressed vapors from the vacuum pump is used to water seal the compressor, therefore, the additional seal water to the compressor during the "intermediate pressure" recovery is stopped. The vacuum pump suction pressure ranges from 15 psia to about 3.4 psia during "low pressure" recovery. When the pressure at the blowdown tank separator reaches about 4 psia, recovery is complete and the blowdown tank or poly is isolated from the recovery system.

At this point, recovery is complete so the vacuum pump and compressor are both unloaded of the seal water which forms the liquid ring seal and the gas bypass valves are opened. This unloading results when the inlet seal water is reduced and the unloader valve V-SP-4/CM-2F or 4F allows the seal water to drain from the 2nd stage compressor housing. A relay holds the system unloaded until the inlet pressure exceeds 30 psig on the next recovery charge cycle so it will not load up when the gas in the separator SE-1/CM-2F or 4F equalizes through the bypass valves.

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The vacuum pump-compressor set (CM-3F & 4F) used for "intermediate" and "low pressure" poly recovery is identical to the vacuum pump-compressor set (CM-1F & 2F) used for "intermediate" and "low" pressure recovery of the charge in the blowdown tank and can be used as a spare for CM-1F & 2F if they are out for repair or maintenance.

The recovery vapors from both the poly recovery and charge recovery are handled in the same way through the vacuum pump-compressor sets. The vapors from charge recovery and poly recovery are combined in a common header and flow to the desuperheater-condenser system.

Desuperheater

All monomer, whether from "high pressure", "intermediate pressure" or "low pressure" recovery, is passed through a shell and tube desuperheater (HE-2F). The refrigerated water on the shellside of the heat exchanger is throttled to control the recovery vapor temperature leaving the desuperheater at about 55°F. Some water vapor will be condensed in the desuperheater.

Condenser

The desuperheated recovery monomer vapors pass to a shell and tube recovered monomer condenser (CN-1F or 2F). The refrigerated water on the shellside is throttled to control the condensing pressure at about 25 psig. The condensing temperature range will be about 55°F to 45°F.

All the condensed monomer and water is gravity drained to a decanter, DE-1F, and then to one of the recovered monomer storage tanks TK-1F or TK-2F. One storage tank will be used to collect condensed recovered monomer while the other is used for charging the recovered monomer back into the polymerizers. The water is drained from the decanter as required and from the recovered monomer storage tanks prior to being switched to monomer charging. This water saturated with monomer is stripped of monomer in TK-3F and then drained to the sewer.

Vent System

All vapors which were not condensed in the monomer condenser are sent to the vent system. The recovery vent system consists of a high pressure compressor (CM-9F), vent condenser (CN-3F), vent gas analyzer (GA-T-1/CN-3F), back pressure control valve (V-D-1/CN-3F), and flow transmitter (F-T-1/CN-3F).

The vapor to the vent system is compressed to about 85 psig and then passed through the vent condenser. The monomer condensed at this pressure is added to the condensate stream from CN-1F or 2F which drains to the monomer storage tanks via DE-1F. The noncondensibles are analyzed for oxygen before being vented to the atmosphere by throttling across a back pressure control valve. The vent flow rate is measured across OR-1/CN-3F.

Seal Water System

The seal water or compressant requirements for both vacuum pump-compressor systems are handled by the seal water system. The seal water system consists of a seal water hold up tank, TK-6F, seal water pump, PU-3F (or 7F), and the seal water heat exchanger, HE-1F. The seal water system is a closed loop water system with any excess seal water sent to the water stripping system.

The seal water from the compressor is separated (SE-1/CM-2F or 4F) from the compressed monomer vapors and sent to the seal water hold-up tank. The seal water is pumped from this tank through the seal water heat exchanger and back to the vacuum pumps and compressors. The seal water cooler is a shell and tube exchanger with cooling water on the shellside. As the seal water level increases in the seal water hold up tank, TK-6F, the excess seal water is sent to the water stripper, TK-3F.

Water Stripping System

The water stripper system consists of a stripping tank, TK-3F, with a steam heater and a pump-out pump controlled by a level controller on the tank.

All water saturated with monomer vapors must be sent to the stripping system before being drained to the sewers. The monomer vapors are stripped from these waters by heating the saturated water and recovering the released vapors through one of the vacuum pump-compressor systems.

Chilled Water System

Refrigeration water is supplied by an ice reserve system. Since heat removal loads are periodically swinging from almost no load to peak load, refrigeration requirements must do the same. During no load an ice reserve system will build ice. At the peak load of approximately 300 TR the ice can be melted to supply the demand. This type of system allows the refrigeration equipment to maintain a stable refrigeration load of approximately 100 TR and reduces the capital expense of buying equipment sized for peak capacity requirements. The refrigerated water is pumped in a closed loop through the ice reserve unit where it is cooled to 32°F and back to the users, HE-2F, CN-1F or 2F and CN-3F.

Recovery Level	Charge Recovery	Poly Recovery
1) "Hi Pressure" above 30 psig	From: Blowdown Tank Thru: Poly (4300 gal.) SE-6F (500 gal.),TK-7F (10000gal.),FIL-5F (or 6F), HE-2F & CN-1F or 2F, to: DE-1F & TK-1F or 2F	Emergency only-same route as charge recovery, but direct from poly containing a full or partial charge.
2) "Intermediate Pressure" 30 psig down to 0 psig	From: Blowdown tank (poly isolated) Thru:SE-1F,2F or 3F, SE-5F (water spray), FIL-3F (or 4F), CM-2F (1-stage compression), HE-2F & CN-1F (or 2F), to: DE-1F & TK-1F (or 2F).	From: Isolated poly Thru: FIL-1F (or 2F), CM-4F (1-stage compression), HE-2F & CN-1F (or 2F), to: DE-1F & TK-1F (or 2F).
3) "Low Pressure" 0 psig down to 3.4 psia	Same as "intermediate pressure" except Thru: CM-1F & 2F (2-stage compression, 3.4 psia to 30 psig).	Same as intermediate pressure except Thru: CM-3F & 4F (2-stage compression 3.4 psia to 30 psig).

	System Status		
	(2) By Pass (High) CM System	(3) Half Load (Intermediate)	(4) Full(Low Press.) Load or Manual Evacuation
or	Process Vapor Direct to HE & CM	2nd Stage Compression only	Two Stage Compression
	30-35 psig up to Peak & back down to 30-35 psig	30-35 psig down to 0 psig - 10.5 psia	0 psig - 10.5 psia down to -4 psia
----------		-------- O P E N --------	
--------- O P E N ---------			---- CLOSED----
-------- O P E N --------			
------ C L O S E D --------			---- OPEN ----
--		------ C L O S E D ------	
-------- O P E N --------			
--		--O P E N---	----CLOSED----
--		------ C L O S E D ------	
[illegible] ABOVE 0 PSIG---		------ C L O S E D ------	

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"G" AND "H" FLOWSHEETS

DESIGN CONSIDERATIONS

General:

Flowsheets "G" and "H" show the equipment required for the drying of the resin produced on "D" flowsheet. These flowsheets, "G" and "H", are identical in form, differing only in size of equipment and design capacity. Flowsheet "G" and its material balances and equipment specifications are for a dryer nominally rated to produce 8,000 pounds per hour of dry resin, while "H" flowsheet and its material balances and equipment specifications are for two dryers nominally rated to produce 5,000 pounds per hour of dry resin per dryer.

Process Description:

Each dryer is fed from its own slurry (G-7) circulation system which originates on "E" flowsheet. Approximately 125 gpm is pumped into each circulation line at the blend tank area and a controlled flow from this is fed to a centrifuge with the balance returning to the blend tank of origin.

For simplicity "G" flowsheet will be described. The same description wil apply to "H" flowsheet,except for size, if the equipment item number references are changed from "G" to "H" and the quantity of each item doubled.

The slurry feed to the dryer passes through a control valve (VD-1/CE-1G), a magnetic strainer (SE-1G), and a sparge type heater (HE-3G) before discharging into the open feed funnel of a Bird Continuous Solid Bowl Centrifuge (CE-1G). A torque controller (TOR-CRA-1/CE-1G) regulates the slurry feed control valve to maintain a constant load on the centrifuge gear unit. A complete description of the torque controller operation is given in the Instrument section [illegible]. The effluent from the centrifuge is discharged to the Industrial [illegible] suitably trapped to remove suspended solids.

The wet PVC solids discharges from the centrifuge continuously to a Syntron Vibrating Feeder (CV-1G) which conveys the wet solids into the First Stage Dryer (DR-1G). A rotating cage (FL-1G) located in the conveyor trough helps even out the flow of solids to the first stage dryer.

The First Stage Dryer (DR-1G) is a flash dryer. Outside ambient air to the First Stage Blower (BL-1G) passes through a two stage filter (FIL-1G) to remove dust. The air is then tempered by a heater (HE-1G) which has a face and by-pass control system to give a constant 100°F imput to the blower. The blower discharge is heated by a finned-tube type air heater (HE-2G), as required by the temperature control system, and passes next into a stainless steel plenum. The hot air plenum is designed with walk-in doors for cleaning and is designed and suitably reinforced, for an internal pressure of 8" W.G. maximum. The heaters and plenum are insulated suitably for safety and economy at a maximum internal air temperature of 350°F. The hot air is discharged from the plenum through a bell-type discharge in the plenum top at a sufficient velocity to disperse and entrain the wet PVC solids introduced by the Syntron Vibrating Feeder (CV-1G). The first stage dryer duct is designed to have zero static pressure at the feed point. The pressure balance in the system is attained by using an inlet blower (BL-1G) to compensate for the system pressure drop up stream of the feed point or throat and an exhaust blower (BL-3G) to supply the pressure for that section of the dryer downstream from the throat. From the feed point, the hot air and PVC solids pass into a low velocity section of vertical duct and then into a high efficiency cyclone (SE-2G) which removes most of the powder from the air. The temperature of the air leaving (SE-2G) is controlled by a temperature controller which varies steam to part of the coils which make up HE-2G.

The powder collected in the high efficiency cyclone (SE-2G) discharges constantly through a screw conveyor (CV-2G) into a second stage conveying-drying system (DR-2G). The screw conveyor has a hinged plate type pressure seal across the discharge end so that it acts as an air lock.

The Second Stage Dryer (DR-2G) is a suction conveying system in which outside air is drawn in through a two stage filter (FIL-2G) and heated by an air heater (HE-4G) before the partly dried powder is introduced by the screw conveyor (CV-2G). A high efficiency cyclone (SE-3G) recovers the dry powder.

The air from (SE-3G) is exhausted by a stainless steel exhauster (BL-2G)

which discharges into the duct carrying exhaust air from the first stage dryer. The combined air exhaust from both drying stages is further cleaned of fine dust by a multitube dust collector (SE-4G) of the "Aerotec" type before being discharged to the atmosphere by the main dryer exhauster (BL-3G). The fines recovered by SE-4G can be discharged as a separate product or blended back into the discharge from the cyclone (SE-3G).

The cyclone (SE-3G) product discharges continuously through a screw conveyor airlock (CV-3G) to a pair of screeners, (SCR-1G & SCR-2G) which can be operated either separately or in tandem. A magnet is installed above each screen to collect any magnetic tramp metal. Tailings from the screens are collected in drums and further processed on Flowsheet "J". Product from the screeners is conveyed by a suction conveying system (BL-4G) to a cyclone type collector (SE-7G) which can discharge through a screw conveyor airlock (CV-5G) to either of two resin bins (TK-1G) or (TK-2G). This is the only point where the large and small dryer systems differ; the two smaller dryers as depicted on "H" flowsheet have a special airlock valve (V-SP-3 & 4H) instead of a screw conveyor due to the lower drying rates. The discharge of BL-4G is into the storage bin, thus, any resin that is not separated in the collector still goes into the bin. In order to switch from one bin to the other, the duct-work at the bottom of the collector SE-7G, as well as at the discharge of blower BL-4G, must be changed to the proper bin.

Two storage bins (TK-1 & 2F) are provided for each dryer system. The bins are constructed of carbon steel and all surfaces exposed to resin are epoxy coated. Each bin is equipped with a fluidizing system consisting of a fluidizing pad and a fluidizing air source.

The bins can be used as secondary dryers by fluidizing with heated air or be fluidized to aid in the transferring of resin from the bins. The Roots Connersville (CM-1G) air compressor supplies air to both bins and is equipped with a heat exchanger (HE-5G) for cooling and heating the air as needed. CM-1G is also equipped with an inlet filter-silencer, discharge silencer, relief valve,

high air temperature switch, and low oil pressure switch.

A Day dust collector (SE-5G & 6G) is mounted on each bin with a storage bin exhaust blower (BL-5 & 6G) located on the discharge line from the dust collectors. Generally, it will be necessary to have either storage bin exhaust blower running, depending on which bin is being used, for the purpose of relieving back pressure in the bin. At times it may be necessary to have both blowers running because one bin is filling from the dryer and the other fluidizing for drying or transfer. Each bin is equipped with two sampling points, one near the bottom and the other about 2/3 of the way from the bottom.

All parts of the drying system from the outlet flange of the air heater (HE-2G) up to the multi-tube dust collector (SE-4G) air discharge stack are stainless steel. Galvanized steel is used on the multi-tube dust collector air discharge stack.

The dryer is interlocked so that failure of any equipment motors downstream of the centrifuge will cause the feed valve (V-D-1/CE-1G) to close but allow the centrifuge to run. Excessive torque or vibration will automatically shut down the centrifuge motor. A panalarm is provided to indicate the source of trouble in the system.

"J" FLOWSHEET

General

The bulk handling, bulk storage, vacuum cleaning unit, and packaging systems required for "Pearl" type PVC polymers are outlined on this flowsheet. Facilities in addition to those already in existence, are provided for bulk storage of PVC, for batch transfer to hopper cars or trucks, for semi-continuous transfer to the bagging station (PK-1J) and for transfer to the compound line hoppers on "K" and "N" flowsheets.

Bulk Handling and Storage Systems

The heart of the bulk handling system is the "Graun-Flow Package" which is outlined on the flowsheet with broken lines. This system was designed and supplied to meet specifications S-4337 and S-4621 by the Material Handling Dept. of The B.F.Goodrich Company.

The Granu-Flow system shown consists of three pressure storage silos (TK-1J thru 3J), each of 7000 cu.ft. capacity with all controls and auxiliary equipment required to operate the silos as pressure transfer vessels.

This is the first time silo storage units have been installed at the Avon Lake plant that function as pressure transfer vessels. Similar units have been installed and are in operation at the Long Beach plant. The operation of the Granu-Flow pressure silos as conveying units follows the same procedure as used for the regular, smaller Granu-Flow transfer units. The three silos have available to them two separate blower packages (CM-1/TK-1J & CM-1/TK-2J), capable of supplying air to any two of the silos at any time. Thus, the two selected silos are capable of conveying resin while the third cannot. Also, when the silos are being used to convey, resin cannot be transferred into them.

Each blower package consists of a 40 hp and a 75 hp blower receiving air through cooling and heating coils. During required cooling, the coils have the capability of cooling 1600 C.F.M. of air from 250°F to 140°F when supplied with 38 GPH of cooling water. During the heating cycle, the same 1600 C.F.M. of air may be raised from 52°F to 140°F when supplied with steam at 180 P.S.I.G.

As mentioned previously, the Granu-Flow system functions as a resin conditioner as well as a resin conveyor. During the conditioning cycle, both blowers operate for the required length of time. When conveying only is required, the 40 HP blower is the only one used. The silos are housed in a building above a rail siding, with heating facilities adequate to maintain a 50°F minimum temperature around the silos in winter.

The resin will be received from the dry product storage bins (TK-1 & 2G and TK-1 to 4H) by means of three Granu-Flow conveying units (CV-1 to 3J), one for each drying line. The conveying units consist of three 50 cubic ft. Granu-Vessels with individual control panels and a transfer rate of 15,000 pounds per hour per unit.

Two blowers (BL-A/CV-1J and BL-B/CV-2J) are provided to supply air for the conveying units, allowing only two of the three units to be operated at any one time. A series of "start", "stop" and selector switches are located on a panel at each unit. A complete operating sequence list and typical panel face diagram is shown on the "J" flowsheet. The units are equipped with a counter. The counter is set at the beginning of the sequence to the number of batches to be conveyed. The system then cycles until the counter counts out and shuts the system down.

The transfer units are connected directly to the individual drying lines and cannot be used interchangeably. A manual disconnect station with quick-coupled hose is located on the outlet manifold from the transfer units to minimize contamination problems. When material is to be transferred into a silo, the selector switch on the control panel for the silo to be filled must be set in the "Receive" position which will automatically set the valves at the silo to the proper position, the hose connection must be made to the silo fill line, then the transfer system at the origin of the transfer can be started. A similar manual disconnect station is located on the outlet transfer lines from the silos.

Packaging System

The packaging system consists of one bagging line with a maximum capacity of 480 fifty pound bags per hour. Resin is carried to the packer by a Granu-Veyor conveyor (CV-4J) equipped with urethane foam air pads. The packer (PK-1J) is a dual spout fluidizing type with an anticipated accuracy in the range of ± 2 ounces on 95% of the weighings. During the filling operation, the resin flows from the storage bin through a transistion hopper into a pressure chamber where the resin is fluidized prior to delivery into the bag. The pressure chamber is separated from the transistion hopper by a butterfly valve. After filling, the resin is cleared from the spout by an automatic purge after which an automatic timer-controlled tilting bag ejector discharges the filled bag. A portable scale (SC-1J) is supplied to check-weigh bags of resin.

Tailings Handling System

This system is designed to dispose of tailings accumulated from the product screeners (SCR-1G & 2G) and (SCR-1H to 4H). Drums of tailings are sucked into a suction conveying system by (BL-1J), collected by (SE-1J) and discharged to a screener (SCR-1J) which scalps out coarse material and makes two product cuts which are collected in 2500 lb. capacity hoppers (HPR-1J thru 4J). From the hoppers the PVC is bagged by a screw type bagger (PK-1J), palletized and stored in the warehouse. The drums of tailings from the tailings screener (SCR-1J) are disposed of as scrap. A portable scale is required at this location to check weigh bags of resin.

Vacuum Cleaning System

A central vacuum cleaning system (VCS-1J) is supplied with outlets conveniently located around the dryer areas. The system provided is a Hoffman Vacuum Producer rated at 250 CFM @ 7" Hg. vacuum. The system has enough capacity so that vacuum hoses can be used in two different locations at the same time. The outlets are

DESIGN CONSIDERATIONS

General

The Avon Lake General Chemical Plant has been plagued with difficulties in the polymerization reaction as a result of organic contamination in the process water. The equipment shown on "W" flowsheet represents the first step in a two phase operation to insure final process water free of contamination which will be able to meet the necessary polymerization and operating requirements.

In general, the system consists of a clarifier unit (WS-1W) to partially remove suspended organics in the form of bacterial growth from the incoming Avon Lake city water (Lake Erie water); a filter to remove submicron particles (FIL-1W) which passed through the clarifier; and a pair or activated carbon filters to remove free chlorine and dissolved organics (FIL-2W & 3W). The equipment as specified, is designed to clarify and filter water at rates up to 400 gpm.

Clarifier System

The clarifier system consists of a package chemical feeder (Ferri-Floc unit) to provide the necessary ferric sulfate (TK-1 & 2W) and caustic (PU-3W & 4W) for the 400 gpm Permutit clarifier (WS-1W). The clarifier was originally installed at the Henry Plant and moved to the Avon Lake Plant for the 1966 Resin Expansion. The system also contains a vacuum chlorinator to kill the biological organisms prior to the Ferri-Floc addition step.

City water is pumped into the clarifier from existing pits (Pit nos. 1 & 2). In the clarifier mixing zone, the city water is treated with chlorinated water and Ferri-Floc solution. The precipitate and residue in the form of a sludge is concentrated and "blown off" from the sludge zone of the precipitator on an adjustable time cycle (TM-2/WS-1W). The addition of the chemicals to the clarifier is accomplished through an automated system on a timed cycle (TM-1/WS-1W) based on flow measurement (OR-1/WS-1W) and control (F-CR-1/WS-1W) of the city water to WS-1W.

After leaving the clarifier, the clarified water (W-15CL) enters a hold or surge tank (TK-4W). TK-4W is an existing 1000 gallon tank for use in the modified water treatment system. Any excess flow of clarified water that cannot be accommodated in the filter system flows to the cooling tower cold well as make-up water.

Filter System

The clarified water is pumped (PU-5 & 6W) through a series of two types of filters. The first set of filters is made up of two existing R. P. Adams automatic filters rated at 200 gpm in parallel with a new, fully automatic R. P. Adams Poro-Stone Filter (FIL-1W) also rated at 200 gpm, giving a total filtering capacity of 400 gpm. The unit is complete with a diatomaceous earth filter aid precoat system and a set of automation accessories including an ATC card operative program timer. The Adams filters are designed to remove any suspended solids remaining after coagulation with ferric sulphate in the clarifier.

The second set of filters (FIL-2 & 3W) are a dual activated carbon filtering system for removing dissolved organics and free chlorine at the design rate of 400 gpm. The system is of the series, counter-flow design interconnected in such a manner that either filter may serve as a primary unit with the remaining filter serving as a polishing unit. Each unit is capable of carrying the entire load while the other unit is being recharged. Upon re-entry into service, the freshly filled unit becomes the polishing unit. Counter-current operation utilizes the full adsorption capacity of the carbon and insures high quality effluent continuously. The filter media is a macroporous granular carbon of bituminous coal origin, as provided by Ilco. Complete operating instructions are provided in the Illinois Water Treatment Co. booklet. A spare charge of carbon should be maintained in inventory so that spent carbon can be replaced without delay.

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DESIGN CONSIDERATIONS

General

The second step of the two phase water treatment operation as mentioned in the "W" flowsheet write-up consists of reducing dissolved electrolytes in the clarified water by means of the existing demineralizing equipment plus additional and replacement equipment.

Water quality of 1,000,000 ohm-cm resistivity and 0.5 ppm max. O_2 will be produced for polymerizer charging the the new expansion area (BLDG-464) as well as in the existing charging areas of the plant. In addition, the equipment capacity is such that it can provide D.M. water for the entire existing plant polymerization capacity including the 1966 expansion plus an additional future expansion of 16-4300 gallon polys in BLDG.-464.

Dual Bed Unit

Clarified water from the "X" flowsheet equipment flows into the dual bed units consisting of two existing units and one new unit. The new dual bed unit (WS-1X) consists of a strong cation-weak anion exchangers capable of producing 200,000 gallons per day at an average flow rate of 170 gpm (20 oper. hours per day) and a maximum rate of 200 gpm. In parallel operation with the two existing dual bed units (60 and 170 gpm each), the new unit gives the entire system the capability of producing at a maximum rate of 400 gpm.

Vacuum Degassifier

After passing through the dual bed units, the water enters the vacuum degassifier (WS-2X). The vacuum degassifier replaces an atmospheric degasser constructed of wood staves. There was evidence that the old unit was contributing directly to the organic fouling problem mentioned in the "W" flowsheet write-up. The new unit consists of a 4' diameter, 16' straight shell tower rated at 75 psi and full vacuum complete with the necessary evacuating equipment. The effluent from WS-2X will contain not more than 0.5 ppm O_2 and not more than 15 ppm CO_2 when treating effluent from the dual beds at a maximum flow rate of 400 gpm.

Intermediate Storage

Because of the increased flow capacity, additional surge tank capacity was put into the system. A 30,000 gallon carbon steel, epoxy lined, cone roof tank (TK-1X) was installed to supplement the existing 22,000 gallon sump. TK-1X is equipped with a heater (HE-1/TK-1X) to prevent freezing during the cold weather months. The level in the tank is controlled (L-T-1/TK-1X) by closing off the flow from the three dual bed units (V-D-1, 2 & 3/TK-1X) to the degassifier. The effluent flow from TK-1X is maintained to the sump by a level controller (L-C-1X) operating a valve (V-D-2X) in the transfer line. At low level, the same level controller shuts down the transfer pumps from the sump. One additional sump pump (PU-3X) rated at 200 GPM was added to bring the pumping capacity up to 400 gpm.

The quality of water from the two step demineralization system should have a resistivity in excess of 100,000 ohms with a O_2 content of 0.5 ppm or less. Water of this quality can be used as process flush water in the polymerization and drying areas of the plant. The design of this part of the improved system was based on an average demand of 87 gpm. Care should be exercised to prevent this water from being used for unauthorized purposes.

Mixed Bed System

Additional capacity was added to this area in the form of a mixed bed polishing demineralizer capable of producing 200,000 gallons per day at an average flow rate of 160 gpm and a maximum rate of 200 gpm. As with preceeding areas, this brings the capacity of the mixed bed system up to 400 gpm.

The mixed bed units discharge into an existing 30,000 gallon storage tank ("beer" tank). Additional storage capacity was added to the system for the storage of the polished charge water; however, the new 40,000 gallon tank (TK-20C) was located next to the new polymerization building (B-464). The tank is equipped with a level controller (L-CI-1/TK-20C) to shut off the incoming water when full. A more complete description of the tank is included in the "C" flowsheet write-up.

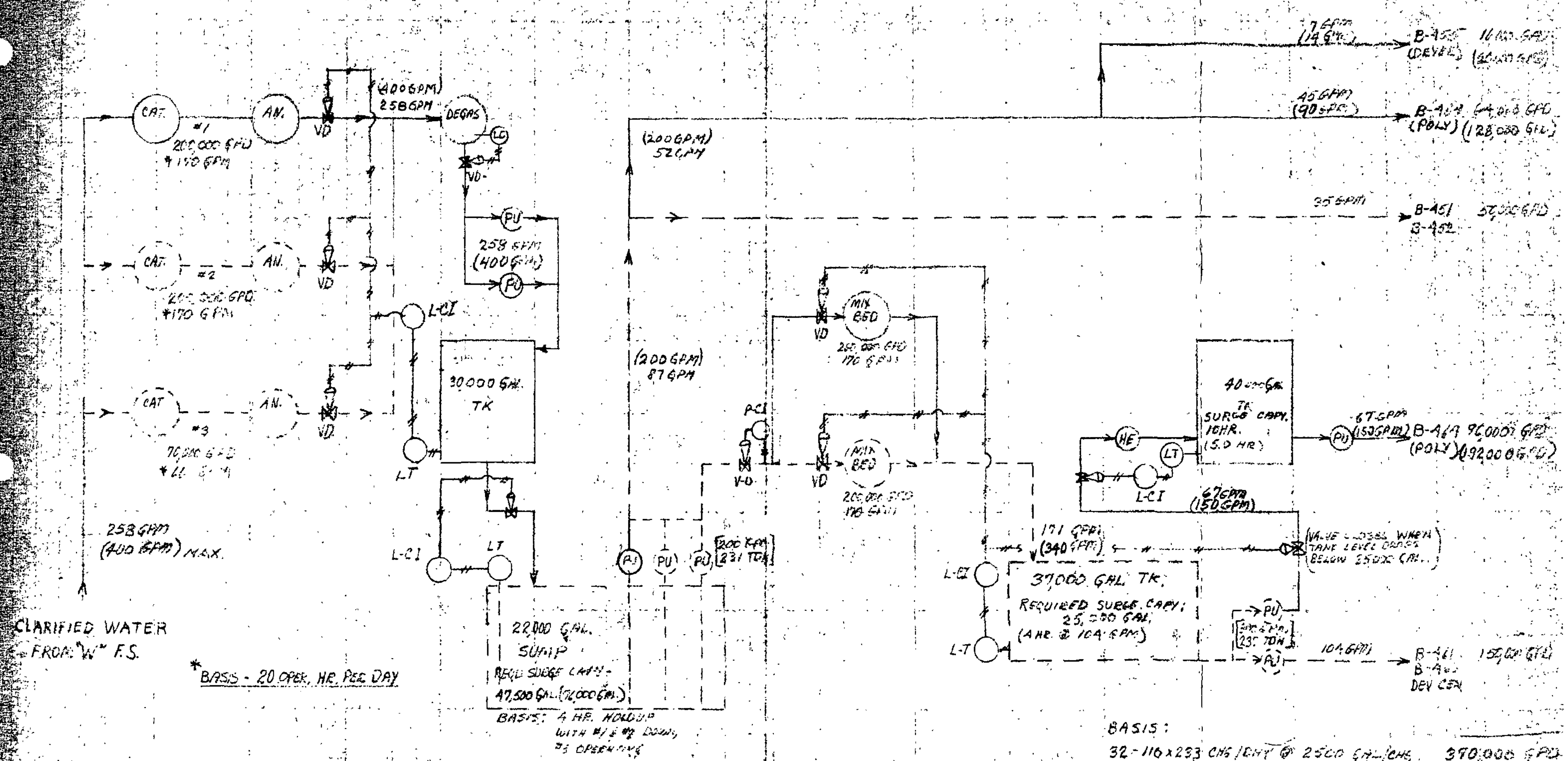
Water quality is measured at three locations with recording conductivity instruments. Water conductivity is measured and recorded at the dual bed system, at the mixed bed units and just before the heat exchanger (HE-1C) for the hot water storage tank (TK-20C). The instruments on the demineralizing beds are provided with the units. The conductivity instrument (CD-CA-1/HE-1C) at the storage tank sounds an alarm and should make it possible to keep poor quality water from entering the tank. The charging water in TK-20C has a quality of 1,000,000 ohms resistivity and 0.5 ppm O_2 at normal operating conditions.

Regeneration

All the new units are designed for automatic regeneration, with the regeneration cycle being initiated manually after notification by volumetric or conductivity meter alarms. The regenerant addition system consisting of acid (H_2SO_4) and caustic pumps and tanks serves both the dual bed and mixed bed units. Interlocks are provided to prevent simultaneous regeneration of the units.

JWG

BY ____ DATE 3-1-66	SUBJECT AVON LAKE ... EXPAN.	SHEET NO. 1 OF 1
CHKD. BY ____ DATE ____	"X" FLOWSHEET	JOB NO. 10558
3 ISSUE 3-20-67 JWG	D.M. WATER DISTRIBUTION	PD 513



BASIS:

32 - 116 x 233 CHG/DAY @ 2500 GAL/CHG. 370,000 GPD

INITIAL WATER + 500 GAL/CHG. (540,000 GPD)

INJECTION WATER

RATES SHOWN ARE AVERAGE RATES BASED ON 24 OPERATING HOURS/DAY.

RATES IN PARENTHESES ARE BASED ON FUTURE 16-4300 GAL. POLYS IN B-464

SURGE CAPACITY BASED ON 4 HRS. HOLD UP

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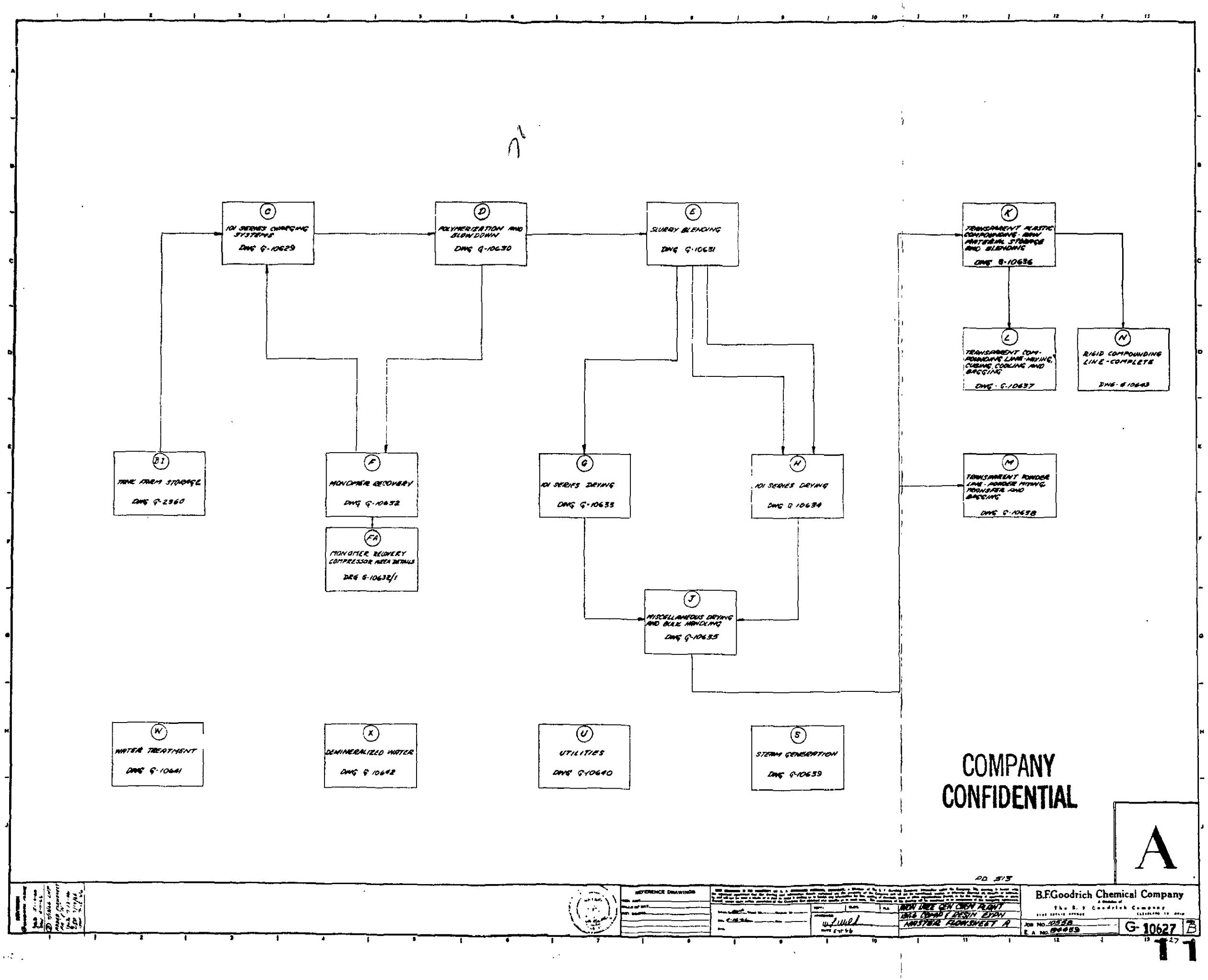
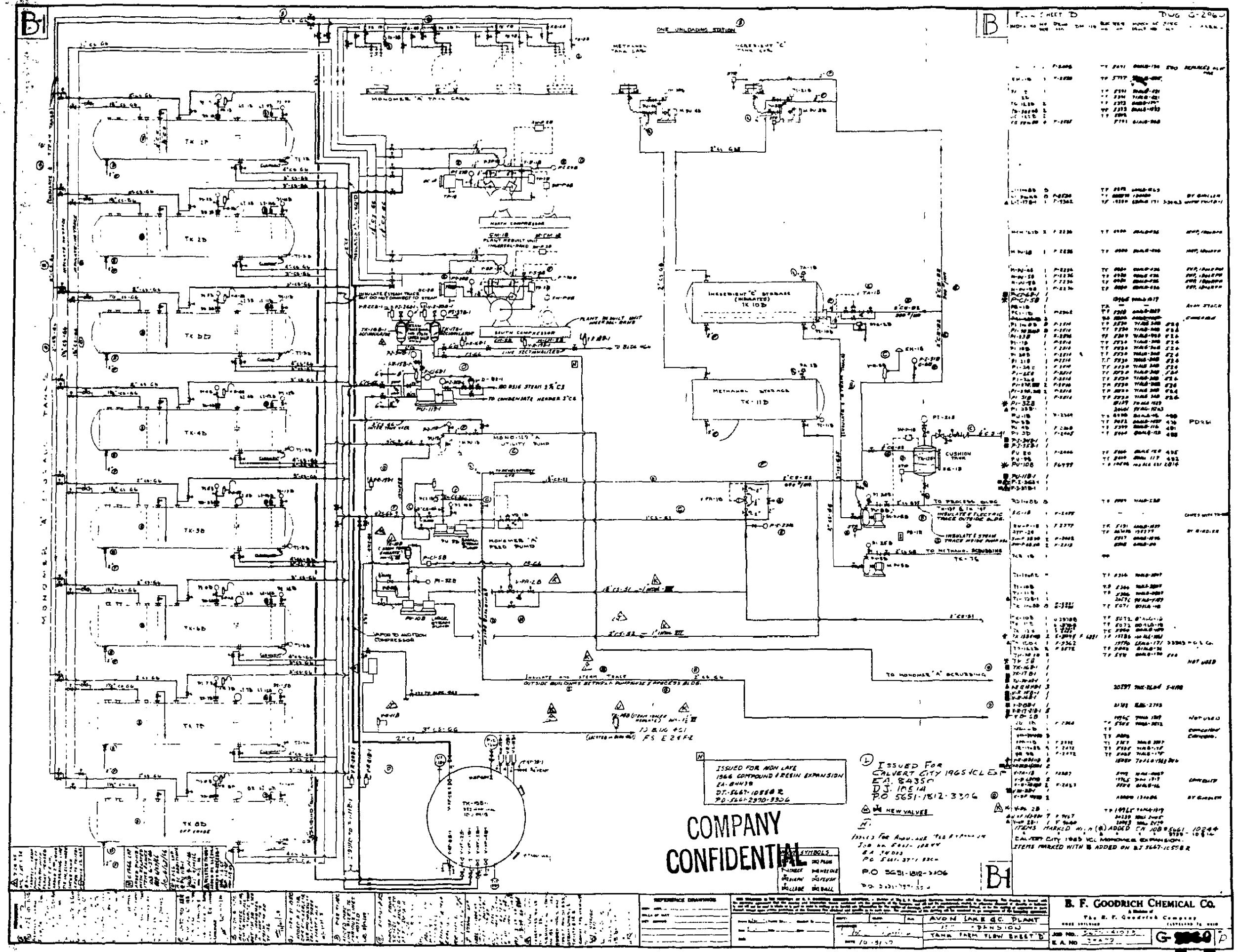
PROCESS FLOWSHEETS

Letter	Dwg.No.	Flowsheet Title
A	G-10627B	Master Flowsheet (Block Diagram)
B-1	G-2960P	Tank Farm
C	G-10629E	Charging Systems
D	G-10630D	Polymerization and Blowdown
E	G-10631C	Slurry Blending
F	G-10632C	Monomer Recovery
FA	G-10632/1C	Monomer Recovery (Compressor Details)
G	G-10633E	Large Venturi Dryer
H	G-10634E	Small Venturi Dryers (2)
J	G-10635B	Bulk Handling and Bagging
K	G-10636B	Raw Material Storage and Blending
L	G-10637B	Transparent Compounding Line
M	G-10638B	Transparent Powder Line
N	G-10643B	Rigid Compounding Line
S	G-10639B	Steam Generation
U	G-10640C	Utilities
W	G-10641B	Water Treatment
X	G-10642E	Demineralized Water





Made by DMc 3-26-66 Job No. 10578
Approved JWO ELP Charge: 5661-2370-

LOCATION	C - FLOWSHEET Issue C 1966 Avon Lake Resin and Compounding Expansion	TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH: TOTAL	N_2	Water	VCl	Emulsifier	Calcium Acetate	CAO-3 Shortstop	Hexane	
	Hi Pressure N_2 to Reducing Station		310 min.			4.61 SCFM (Ave) 213 SCFM (Inst)	6044 SCF/day	6044 SCF/day							
2	N_2 to Emulsifier Charging Tanks	80	230			4045 SCFM	*162.0	*162.0							
3	Recovered VCl Charging to PLY-1D-16D	80	200	0.903	0.174 cp	100 GPM	*4140			* 4140					
4	DM Water to Storage Tank, TK-20C	60	Atm.	0.999	1.11 cp	150 GPM (max)	798,000 lb/day		798,000						
5	Hot DM Water to Initial Poly addition, PLY-1D-16D	170	200	0.973	0.38 cp	200 GPM	*19,600		*19,600						
6	DM Water to Injection Water System, PLY-1D-16D	170	200	0.973	0.38 cp	1.06 GPM (Ave)	* 3,660		* 3,660						
7	DM Water to Seal Water Flush System, PLY-1D-16D	170	300	0.973	0.38 cp	15 GPH	* 1,380		* 1,380						
8	180 psig Steam to DM Water Preheater HE-1C	380	180		8,250,000 BTU/hr	9,760 lb/hr									
9	180 psig Steam to DM Water Storage Tank Coil-HE-1/TK-20C	380	180		330,000 BTU/hr	390 lb/hr									
10	30 psig Steam to Emulsifier Preparation Tank Coils	274	30		400,000 BTU/hr	430 lb/hr	* 430								
11	Cooling Water To Emulsifier Preparation Tank Coils	85		0.996	0.818 cp	10 GPM	*2500								
12	Nitrogen to Short-Stop Tank TK-23C	80	230			29.8 SCFM	* 29.8	* 29.8							
13	N_2 to Booster Compressor	80	100			215 SCFM (Inst)	6640 SCF/day	6044 SCF/day							
14	Injection & Seal Water to Bypass Cooler HE-1/PU-3C,4C	164	380	0.976		32 GPM (Max)									
15	Cooling Water to Bypass Cooler HE-1/PU-3C & 4C	85		0.995	68,000 BTU/hr	3.9 GPM									
16	Emulsifier solution to PLY-1D-16D	170	200			20 GPM	* 200		* 192.7		* 7.26				
17	Buffer Solution to PLY-1D-16D	170	200			20 GPM	* 14.3		* 11.4			* 2.86			
18	Short-Stop to PLY-1D-16D	Amb.	200			6 GPM	* 27.5						* 11.0	* 16.5	
(C) 19	Cooling Water to Jet System VJ-1C	85	50-90psig	1.00	0.8136	10 GPM	5,000		5,000						
(C) 20	Cooling Water to Jet System VJ-2C	85	50-90psig	1.00	0.8136	10 GPM	5,000		5,000						
(C) 21	Steam to VJ-1C	380	180			225 lb/hr	225		225						
(C) 22	Steam to VJ-2C	380	180			225 lb/hr	225		225						
(C) 23	Condensate & Spent Cooling Water from VJ-1C to TK-24C		Atm.			11 GPM	5,225		5,225						
(C) 24	Condensate & Spent Cooling Water from VJ-2C to TK-24C		Atm.			11 GPM	5,225		5,225						
(C) 25	New VCl to MV-1C & MC-2C	100	249 psig	0.883	0.16	400 GPM	* 9,860			* 9,860					
(C) 26	City Water to High Pressure Poly Cleaning	85	50-90psig	1.00	0.813 cp	20 GPM Avg. 45 GPM Max.	22,500		22,500						
(C) 27	Return Water from Hi Pressure Poly Cleaning	85	50-90psig	1.00	0.813 cp	20 GPM Avg. 45 GPM Max.	22,500		22,500			Revised	- 5-31-66	DMc	
(C) 28	Water to N_2 Comp. Cooler	85	50-90 psig	1.00	0.813 cp	2 GPM	1,000		1,000			Issue C	- 7-19-66	VNA	

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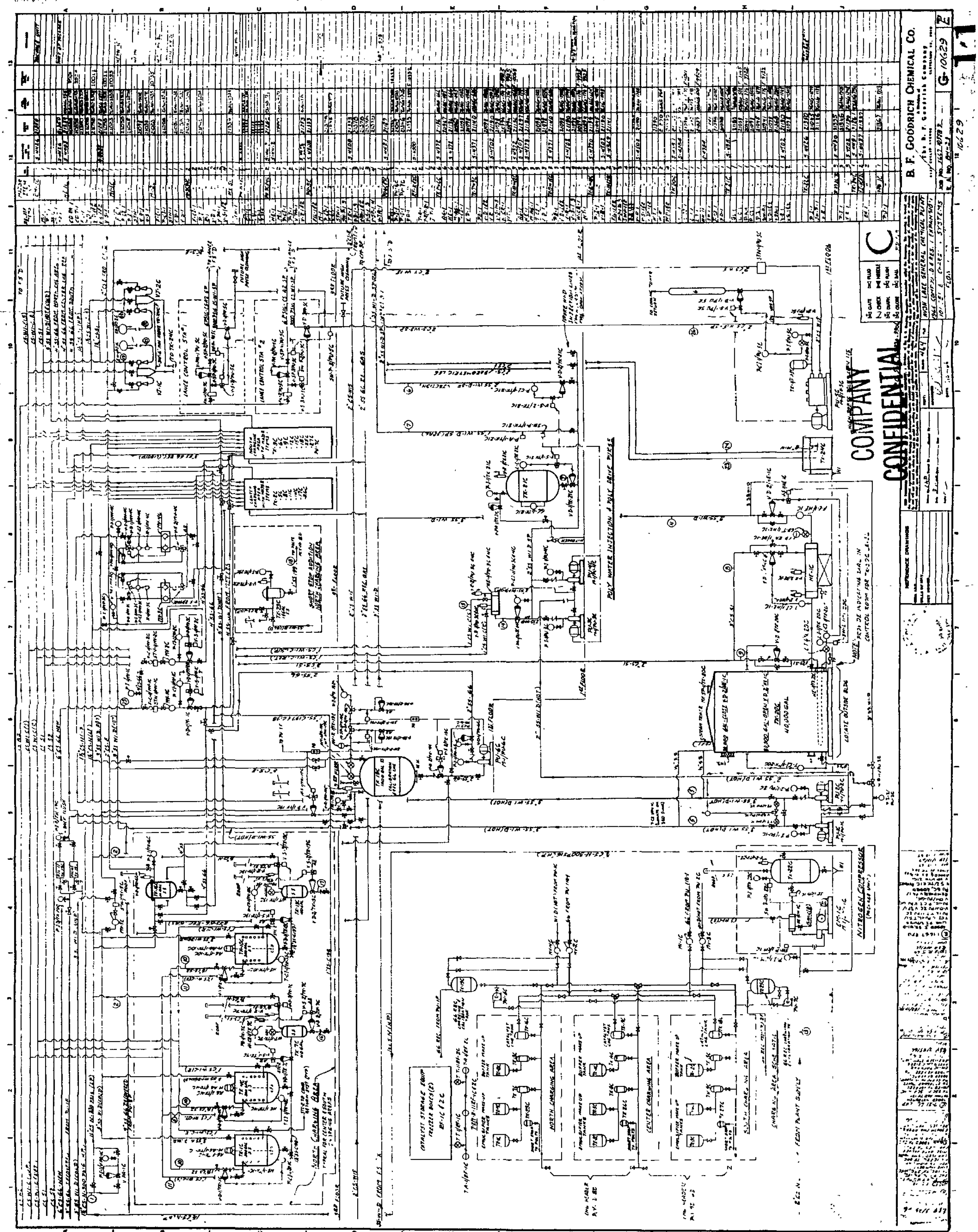

Sheet 2 of 2 Issue A

B - FLOWSHEET

Avon Lake PVC Expansion

Made by VNA Approved [illegible] Job No. PD-513 Charge: DJ 105588

LOCATION		TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTI BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH								
							TOTAL	VCl Charged	IPP Solids	Emulsifier	Hydrated Lime	Water	VCl Recovered	Hexane	PVC
	Evacuation PLY 1-15D	Steam Break →	28" Hg 28" Hg												
2	IPP-Hexane Soln to PLY1-15D	100°F					* 45.5		* 9.1					* 36.4	
3	VCl to PLY 1-15D	100°F	65 psig	0.883	0.16 CPS	200 GPM	* 14,000	* 14,000							
4	Charge Header flush water to PLY 1-15D	85°F	90 psig	0.996	0.818 CPS		* 417					* 417			
5	Hydrated Lime to PLY 1-15D						* 2.2				* 2.2				
6	Emulsifier to PLY 1-15D	130°F	170 psig			5 GPM	* 227			* 8.26		* 219			
7	Initial H_2O to PLY 1-15D	130°F	170 psig	0.9862	0.5146CPS	200 GPM	* 22,700					*22,700			
8	Injected H_2O to PLY 1-15D	130°F	300 psig	0.9862	0.5146CPS	1.44 GPM	* 5,050					* 5,050			
9	Jet Steam to PLY 1-15D (120°F to 123°F)	388°F	200 psig		669,900 BTU/hr.	634 #/hr.									
10	Cooling H_2O to PLY 1-15D	85°F	90 psig	0.996	0.818 CPS	685 GPM max.									
11	Slurry to BDT	110°F	reac.psig 24" Hg	1.16	2.8 CPS		* 42,442	3,920	* 9.1	* 8.26	* 2.2	*28,386		* 36.4	*10,080
12	Sparge Steam to BDT	385°F	192 psig		2,532,000 BTU/hr.	2340 #/hr.	* 1,170					* 1,170			
13	VCl Recovery PLY 1-15D	110°F to 150°F	reac.osig to 24"Hg	0.835	0.13 CPS	750 to 1500 SCFM	* 3,920						* 3,920		
14	Slurry to Blend Tank	150°F	ATMOS	1.16	2.8 CPS	200 GPM	* 39,656		* 9.1	* 8.26	* 2.2	*29,520			*10,080
15	PLY Wash Water	85°F	90psig				* 622					* 622			
16	BDT VAC Break, Steam	Steam Break →	200psig			970 #/hr.									

Design Basis: 72,000,000 lbs. per year Geon 101 EP-F-24 (Alternates: Geon 103 EP-F-7 or 102 EP-F-5)

See Sheet 1 of 2

Sheet 1 of 2 Issue A D - FLOWSHEET Avon Lake PVC Expansion	TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY or or DUTY BTU/hr.	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH TOTAL	VCl Charged	Lauroyl Peroxide	Emulsifier	Calcium Acetate	Water	VCl Recovered	PVC		
Evacuation PLY 1-15D	Steam Break →	28" Hg 28" Hg													
...royl Peroxide to PLY1-15D	100°F					* 6.60		* 6.60							
...l to PLY 1-15D	100°F	65 psig	0.883	0.16 CPS	200 GPM	* 11,000	* 11,000								
... Header flush water to PLY 1-15D	85°F	90 psig	0.996	0.818 CPS		* 417					* 417				
...cium Acetate to PLY 1-15D	130°F	170 psig			0.3 GPM	* 14.3				* 2.86	* 11.4				
...ulsifier to PLY 1-15D	130°F	170 psig			5.0 GPM	* 200			* 7.26		* 192.7				
...itial H_2O to PLY 1-15D	130°F	170 psig	0.986	0.515 CPS	200 GPM	* 20,750					*20,750				
...jected H_2O to PLY 1-15D	130°F	300 psig	0.986	0.515 CPS	0.97 GPM for 8 hrs.	* 3,880					* 3,880				
... Steam to PLY-16D (120°F ... Steam to PLY1-15D to 158°)	388°F	200psig		2,118,000 BTU/hr.	2100 #/hr.										
...ing H_2O to PLY-16D ...ing H_2O to PLY-1-15D	85°F 85°F	90 psig 90 psig	0.996 0.996	0.818 CPS 0.818 CPS	783 GPM max. 610 GPM max.										
...urry to BDT	146°F	reac.psig to 24" Hg	1.16	2.8 CPS		* 36,268	* 2,200	* 6.60	* 7.26	* 2.86	*25,251		* 8,800		
...rge Steam to BDT	385°F	192 psig		174,360 BTU/hr.	161 #/hr.	* 80.5					* 80.5				
...Recovery PLY 1-15D	158°F to 146° to 150°	reac.psig to 24" Hg	0.825	0.125 CPS	420 to 840 SCFM							*2,200			
... to Blend Tanks	150°F	ATMOS	1.16	2.8 CPS	200 GPM	* 34,149		* 6.60	* 7.26	* 2.86	*25,372		* 8,800		
... Wash Water	85°F	90 psig				* 622					* 622				
... VAC Break, Steam	Steam Break →	200 psig			970 #/hr.										

Design Basis: 72,000,000 lb. per year Geon 110 X 233 (Alternates: Geon 110 X 223 or 110 X 224)

See: Sheet 2 of 2

Made by VNI Approved [illegible] Job No. PD-513 Charge: D.J. 10558

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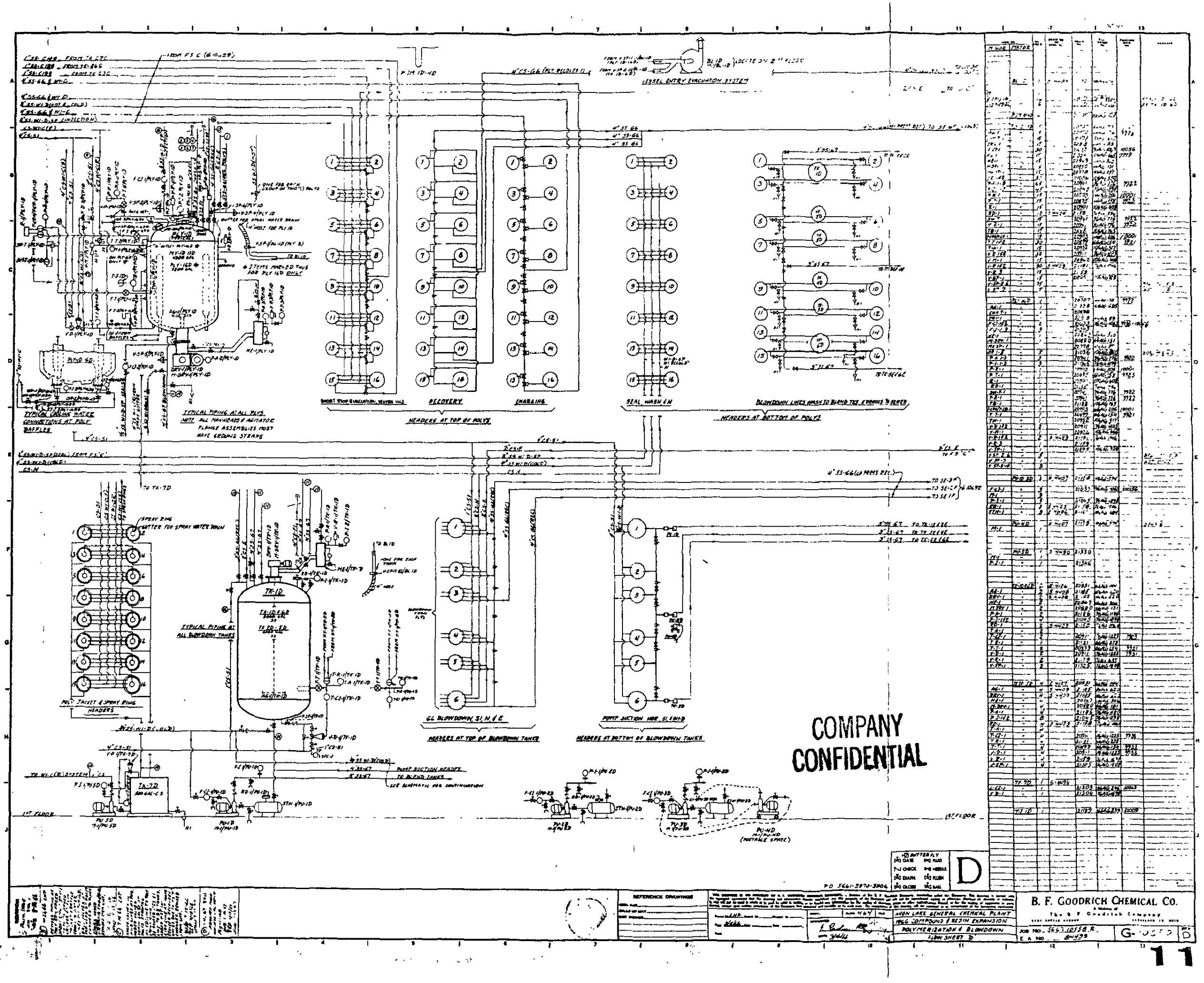

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11

Made by V.N. Arnold Job No. PD-51?
Approved [illegible] Charge: B.J. [illegible]

LOCATION	E - FLOWSHEET Issue 4 Avon Lake PVC Expansion	TEMP. DEG. F.	Slurry PRESSURE Total Solids PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH: TOTAL	PVC Solids	H_2O	
1	Air for emergency agitation									
2	Water flush, lines to pump	85°F		.996	.958					
3	Water to agitators flush chamber	85°F		.996	.958	0.033 GPM				
4	PLY wash down water	85°F		.996	.958					
5	PLY wash down water	85°F		.996	.958					
6	PLY wash down water	85°F		.996	.958					
7	Slurry recycle from large centrifuge	100°F	30%	1.16	2.8 CPS	72 GPM	40,100	12,000	28,000	(See drier flowsheet)
8	Slurry recycle from small centrifuge	100°F	30%	1.16	2.8 CPS	90 GPM	50,000	15,000	35,000	(See drier flowsheet)
9	Slurry recycle from small centrifuge	100°F	30%	1.16	2.8 CPS	90 GPM	50,000	15,000	35,000	
10	Slurry to blend tanks	150°F	30%	1.16	2.8 CPS	200 GPM	* 78,128	* 20,160	* 57,968	(See PLY flowsheet)
11	Slurry to blend tanks	150°F	30%	1.16	2.8 CPS	200 GPM	* 39,064	* 10,080	* 28,984	
12	Slurry to blend tanks	150°F	30%	1.16	2.8 CPS	200 GPM	* 78,128	* 20,160	* 57,968	
13	Drain from separators									
14	Drain from separators									
15	Drain from separators									
16	Water to pump seal	85°F		.996	.958	0.033 GPM				
17	Slurry to dryers	100°F	30%	1.16	2.8 CPS	120 GPM	66,700	20,000	46,700	(See drier flowsheet)

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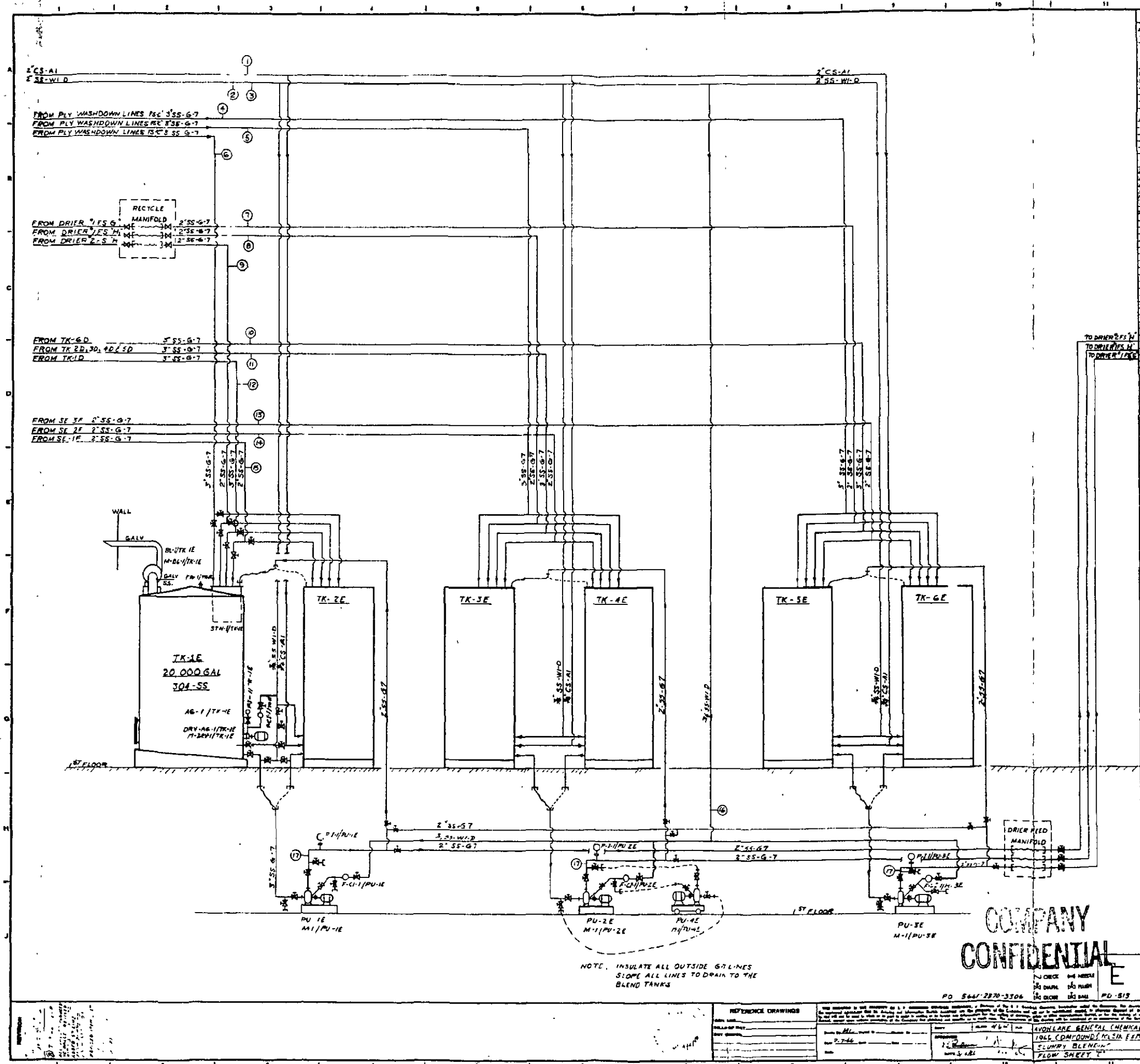

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LOCATION	FLOWSHEET Issue A Pg. 2 of 2	TEMP. DEG. F.	PRESSURE PSIG or MM Abs	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR POUNDS PER BATCH — TOTAL	VCl	H_2O	Air
1	Excess Water from TK-6F to TK-3F	115	0	.988	.57	1 GPM max. as required	400 max.	satd.	400 max.	
32	Desorbed VCl from TK-6F to TK-3F	115	0				232 max.	232 max.	satd.	
33	15% Glycol Brine or Chilled Water from PU-5For6FtoCN-1F-3F	35	56			554 GPM	276,000		276,000	
34	From CN-1F-3F to HE-2F	49	46			554 GPM	276,000		276,000	
35	to CN-1F or 2F	35	30		3,800,000	545 GPM	272,000		272,000	Flow rates based on chilled water
36	from CN-1F or 2F	49	20			545 GPM	272,000		272,000	if a brine system is used
37	to CN-3F	35	30		61,000	9 GPM	4,350		4,350	increase flow rates by 1.2
38	from CN-3F	49	20			9 GPM	4,350		4,350	
39	Sl to HE-1/TK-3F	380	180			as required				
40	Sl to HE-1/TK-7F	380	180			as required				
41	Seal Water to CM-9F	95 max.	50		25,000	10 GPM	5,006	6	5,000	
42	Seal Water from CM-9F	100	85			10 GPM	5,100	100	5,000	
43	Cooling Water to HE-1F	85 max.	50		1,328,000	135 GPM	67,500		67,500	
	Cooling Water from HE-1F	105	40			135 GPM	67,500		67,500	

Made by HS
Approved
Job No.
Charge:

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PD-513 Issue A
F - FLOWSHEET Pg. 1 of 2

Made by HS Job No. 10558-A
Approved [illegible] Charge:

LOCATION		TEMP, DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH TOTAL	VCl	H_2O	Air					
1	HE Pressure Recovery from PLY-1D-16D to SE-6F	125	125 max. 25 min.	1.25 lb/cf .4 lb/cf		350-600 ACFM	25,000 Max. 8,100 avg.	Instantaneous Rate 2,706 *	satd.	1.2 *	Pressure reduction from 90-125 psig in 20 min.				
2	Lo Pressure Recovery from TK-1D-6D to SE-1F-3F	90 - 125	30 max. 3.4PSIAmin	.45 lb/cf		474 ACFM max.	5,200 avg.	463 *	satd.	1.5 *	Pressure reduction from 25-30 psig to 3.4 psia in 5-10 min.				
3	Poly Recovery from PLY-1D-16D to CM-3F or 4F	90 - 125	30 max. 3.4PSIAmin	.45 lb/cf		474 ACFM max.	4,370 avg.	266 *	satd.	1.0 *					
4	Recovered VCl from TK-7F to CM-2F & 4F to CN-1F & 2F	90 - 125	120 max. 25 min.	.4 lb/cf		948 ACFM max.	25,086 Max. 8,100 avg.	3,435 *	satd. 24 *	3.7 *					
5	Lo Pressure Recovery from SE-5F to CM-2F	90 - 125	30 max. 12.5PSIAmin			474 ACFM	10,700 avg.	378*	satd.	1.2 *					
6	Lo Pressure Recovery from SE-5F to CM-1F	90 - 110	12.5PSIAmax 3.4PSIAmin			450 ACFM	8,600 avg.	85 *	satd.	1.3 *					
7	Poly Recovery from PLY-1D-16D to CM-3F or 4F	90 - 128	30PSIAmax 3.4PSIAmin			474-450 ACFM	4,370 avg.	266 *	satd.	1.0 *	(same as 3)				
8	VCl & Seal Water from CM-1F to CM-2F	80 - 120	1PSIGmax. 12.5PSIAmin	(1) (v)		5-30 GPM 474 ACFM	20,200 Max. 2,500 min.	463 *	15,000 max. 2,500 min.	1.5 *					
9	VCl & Seal Water from CM-3F to CM-4F	105	1PSIGmax. 12.5PSIAmin	(1) (v)		5-30 GPM 474 ACFM	19,370 Max. 2,500 min.	263 *	15,000 max. 2,500 min.	1.0 *					
10	VCl from TK-7F to CM-1F	80 - 100	25PSIGmax. 3.4 PSIA			474 ACFM as reqd.	prior to maintenance, etc.								
11	Clarified Water to SE-5F	85	75			6 GPM	3,000		3,000						
12	Liquid VCl from CN-1F or 2F to DE-1F	45	25 - 30	.94	3,780,000 BTU/hr.	53 GPM max. 14 GPM avg.	24,651 Max. 3,426 *	24,609 Max 3,402 *	41.5 max 24 *						
13	Non-Condensables & VCl from CN-1F or 2F to CM-9F	45	25 - 30			20 CFM	436 36 *	391 32.5 *	satd. satd.	44.5 3.7 *					
14	Non-Condensables & VCl from CN-9F to CN-3F	125	85			8 CFM	438.2 36 *	391 32.5 *	satd. .1 *	44.5 3.7 *					
15	Liquid VCl from CN-3F to DE-1F	45	85				348.6 29 *	346 29 *	2.6 .1 *						
16	Vent Non-Condensables & VCl from CN-3F to Roof	45	8				89.6 7.4 *	45 3.7 *	0.1	44.5 3.7 *					
17	Liquid VCl from CN-1F & 3F to DE-1F	45	25			53 GPM max. 14 GPM avg.	24,998 Max. 3,455 *	24,954 Max 3,431 *	43.8 24 *						
18	Liquid VCl from DE-1F to TK-1F or 2F	45	25			53 GPM max. 14 GPM avg.	3,432 *	24,954 3,431 *	6 1*						
19	Decanted Water from DE-1F to TK-6F	55	25			as req'd.	23 *	0.4 0.2 *	37.8 23 *						
20	Recovered VCl Liquid from TK-1F or 2F to TK-19C or 25C	55	44	.93	.22	100 GPM	4,140 *	4,140 *	1. *						
21	Settled Water from TK-1F or 2F to TK-6F	55	25			as req'd.									
22															
23	VCl Stripped from Seal Water from TK-3F to CM-1F or 3F	125	3.4 PSIA 25 PSIG				321	232	89						
24	Excess Water from TK-3F to Sewer	125	3.4 PSIA 5 PSIG	.98		30 GPM	15,000 Max. 3,400 avg.	sat'd. 2 avg.	15,000 max. 3,400 avg.						
25	Seal Water from PU-4F to HE-1F	115	90			80 GPM	40,044	44	40,000						
26	From HE-1F to CM-1F-4F, 9F	95 max.	80			80 GPM	40,044 max.	44	40,000 max.						
27	Seal Water to CM-2F & 4F	95 max.	75			50GPMea.unload. 300GPMea.loaded	2,503 15,016	8 16	2,500 15,000						
28	Seal Water to CM-1F & 3F	95 max.	75			50GPMea.unload. 300GPMea.loaded	2,503 15,016	3 16	2,500 15,000						
29	Seal Water from CM-2F & 4F	117	25	.988		100GPM unloaded 350GPM loaded	5,000 17,588	6 87.5	5,000 17,500						
30	Seal Water VCl to TK-6F	55 - 117				40 GPM	40,275								

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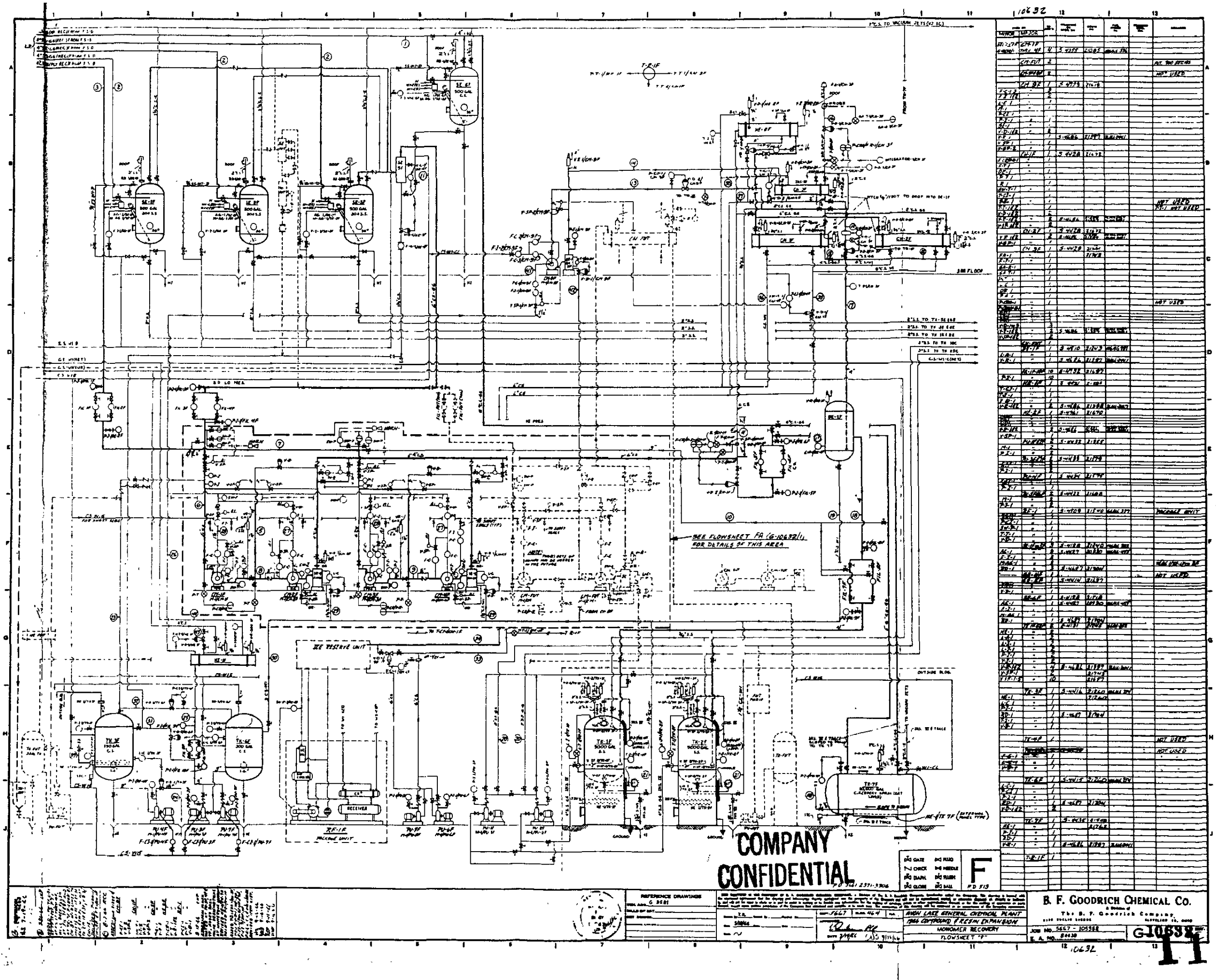

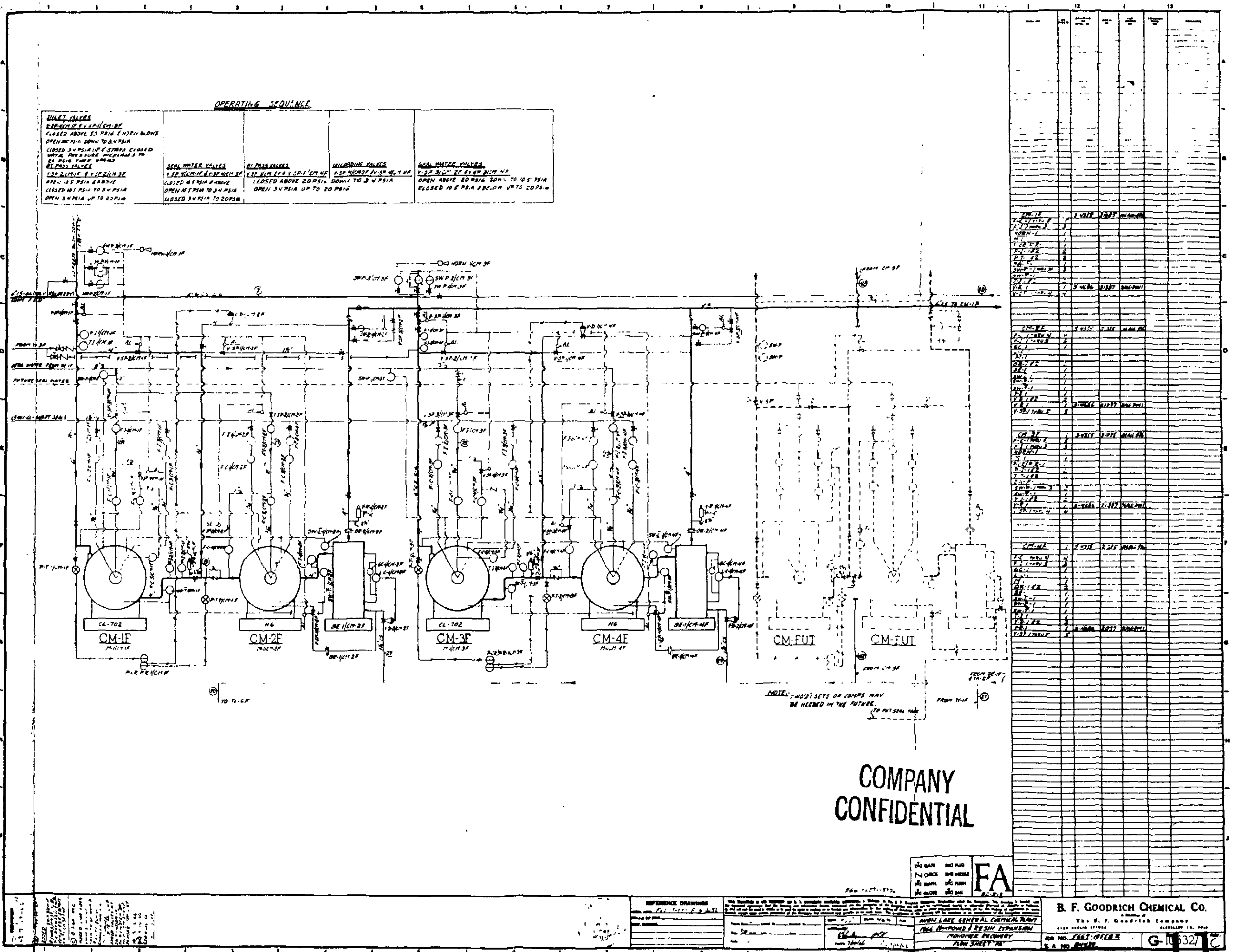

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NGC35908

Made by [illegible] Approved [illegible] Job No. 1095[illegible] Charge: 23[illegible] Page 2 of [illegible]

LOC-ATION	Issue A G - FLOWSHEET AVON LAKE 1966 RESIN EXP. 8000#/hr. VENTURI (FB-513)	TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH TOTAL	PVC	WATER	AIR
28	S2 to Magnet-[illegible]	274	30 psig				10	--	--	--
29	Product from Bins	180	[illegible] psig	30#/ft^3		268 CFH	8,010	7,950	60	--
30	Fluidizing Air to Bin	170	5.5 psig	15.878 ft^3/lb.		1600SCFM	7,200	--	--	7,200
31	S1 to HE-5G	379.5	180 psig		191,000		226	--	--	--
32	W1-C to HE-5G	85				25 GPM	--	--	--	--

Issue A

G - FLOWSHEET AVCO LANE 1966 RESIN EXP. 8000#/hr. VENTURI (FD-513)

Made by ECM Approved [illegible]

Job No. 10554 Charge: 2372

Page 1 of 1

LOCATION		TEMP. DEG. F.	PRESSURE INCHES, H2O (1)	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH							
							TOTAL	FVC	WATER	AIR				
1	Slurry from Blend Tank	100		1.115		120 GPM	--	--	--	--			(25 to 40% T. S.)	
2	Slurry to HE-3G	100		1.115		48 GPM	26,600	8,000	18,600	--			(30% T. S.)	
3	Slurry to CE-1G	170		1.095		51.5 GPM	28,110	8,000	20,110	--				
4	Wet Cake	165		35#/ft^3		304 CFH	10,661	7,991	2,670	--			(25% H. L.)	
5	CE-1G Effluent	165		0.9755		37.2 GPM	17,449	9	17,440	--			(0.05% T. S.)	
6	Air to Bi-1G	100	-2.0"	11.579 ft^3/lb.		14,750 SCFM	66,300	--	--	66,300				
7	Air to HE-2G	100	+4.0"	11.579 ft^3/lb.		14,750 SCFM	66,300	--	--	66,300				
8	Air to Dryer Throat	350	0.0"	19.787 ft^3/lb.		21,865 ACFM	66,300	--	--	66,300				
9	SE-2G Exhaust	160	-14.0"			18,045 ACFM	68,850	40	2,510	66,300				
10	SE-2G Product	160		30#/ft^3		270 CFH	8,111	7,951	160	--			(98.0% T. S.)	
11	Air to HE-4G	0	-1.0"	11.579 ft^3/lb.		6,000SCFM	26,970	--	--	26,970				
12	Air to DR-2G	250	-4.0"			8,100 ACFM	26,970	--	--	26,970				
13	SE-3G Product	160		30#/ft^3		265 CFH	7,967	7,911	56	--			(99.3% T.S.)	
4	SE-3G Exhaust	160	-4.5"			7,100 ACFM	27,114	40	104	26,970				
15	SE-4G Product	150		30#/ft^3		2.7 CFH	80.6	79.6	1	--				
16	SE-4G Exhaust	150	-22.0"			24,709 ACFM	96,334	0.4	2,614	93,720				
17	SCR-1G Tailings	145		30#/ft^3		1.33 CFH	40	39.7	0.3	--				
18	SCR-1G Product	145				3,600 SCFM	24,189	7,991.3	55.7	16,182			(99.3% T. S.)	
19	SE-7G Exhaust	100	-18.0"			3,600 ACFM	16,221	39	0.3	16,182				
20	Exhaust Air from Bins	120	-6.0"			5,200 SCFM	23,398	0.2	16	23,382				
21	Slurry Return	100		1.115		72 GPM	--	--	--	--				
22	S-1 to HE-3G	379.5	180 psig		1,600,000		1,510	--	--	--				
23	S2 to Air Preheater	274	30 psig		1,770,000		1,910	--	--	--				
24	S1 to HE-2G	379.5	180 psig		4,450,000		5,280	--	--	--				
25	Water to CE-1G	85				5 GPM	--	--	--	--				
26	S2 to HE-4G	274	30 psig		1,390,000		1,500	--	--	--				
27	S1 to HE-4G	379.5	180 psig		720,000		865	--	--	--				

Specific gravity at operating temperature and pressure referred to water at 4°C. or air at 60°F. and 14.696 psia

(1) Air pressures refer to inches of water above or below atmospheric pressure

(2) Air volumes refer to 70°F. and 29.92 in. Hg. as standard, density 0.075 lb/ft^3

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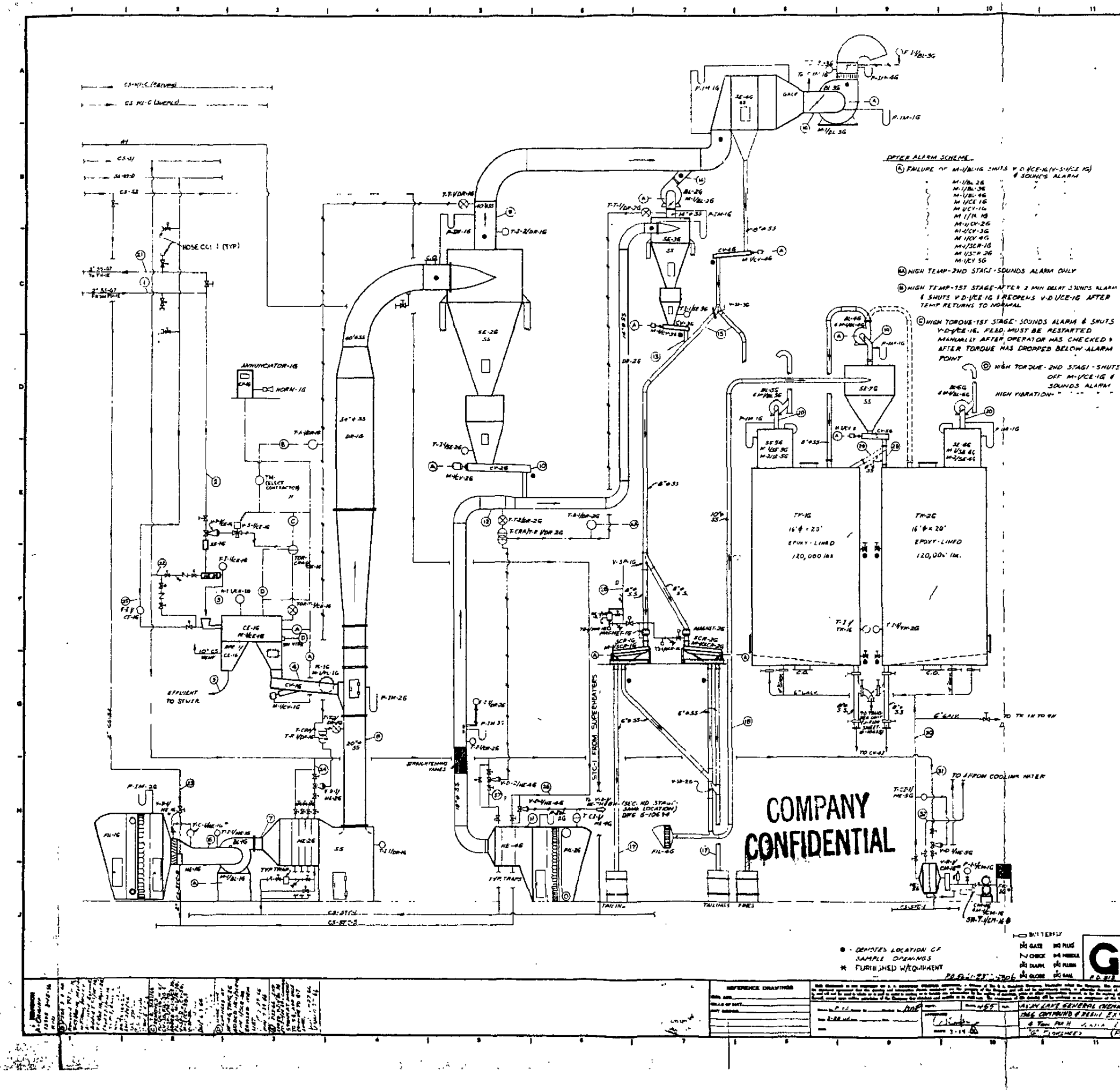
NGC35910



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NGC35911

Issue A

H - FLOWSHEET AVON LAKE 1966 RESIN EXP. 5000#/hr. VENTURI (PB-513)

Made by ECM Approved [initials]

Job No. 10558 Charge: 2372

Page 1

LOCATION	H - FLOWSHEET AVON LAKE 1966 RESIN EXP. 5000#/hr. VENTURI (PB-513)	TEMP. DEG. F.	PRESSURE INCHES W.G.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH: TOTAL	PVC	WATER	AIR	
[illegible]	Slurry from Blend Tank	100		1.115		120 GPM	--	--	--	--	(25 to 40% T. S.)
2	Slurry to HE-5H	100		1.115		30 GPM	16,700	5,000	11,700	--	(30% T. S.)
3	Slurry to CE-1H	170		1.095		31.8 GPM	17,710	5,000	12,710	--	
4	Wet Cake	165		35#/ft³		190 CFH	6,664	4,994	1,670	--	(25% H. L.)
5	CE-1H Effluent	165		0.9755		22.7 GPM	11,046	6	11,040	--	(0.05% T. S.)
6	Air to Bl-1H	100	-2.0"			9,300 SCFM	41,800	--	--	41,800	
7	Air to HE-3H	100	+4.0"	11.579 ft³/lb.		9,300 SCFM	41,800	--	--	41,800	
8	Air to Dryer Throat	350	0.0 psig	19.787 ft³/lb.		14,200 ACFM	41,800	--	--	41,800	
9	SE-3H Exhaust	160	-14.0"			11,300 ACFM	43,394	25	1,569	41,800	
10	SE-3H Product	160		30#/ft³		169 CFH	5,070	4,969	101	--	(98.0% T. S.)
11	Air to HE-5H	0	-1.0"			3,800 SCFM	17,000	--	--	17,000	
12	Air to DR-3H	250	-4.0"			5,120 ACFM	17,000	--	--	17,000	
13	SE-5H Product	160		30#/ft³		166 CFH	4,980	4,944	35	--	(99.3% T. S.)
	SE-5H Exhaust	160	-4.5"			4,500 ACFM	17,090	25	65	17,000	
15	SE-7H Product	150		30#/ft³		1.6 CFH	50.4	49.7	0.7	--	
16	SE-7H Exhaust	150	-22.0"			16,000 ACFM	60,433	0.3	1,633.3	58,800	
17	SCR- 1H Tailings	145		30#/ft³		0.84 CFH	25.2	25	0.2	--	
18	SCR-1H Product	145				2,250 SCFM	15,104	4,969	35	10,100	(99.3% T. S.)
19	SE-9H Exhaust	100	-18.0"			2,420 ACFM	10,125	25	0.2	10,100	
20	Exhaust Air from Bins	120	-6.0"			3,850 SCFM	17,307	.2	7	17,300	
21	Slurry Return	100		1.115		90 GPM	--	--	--	--	
22	S1 to HE-5H	379.5	180 psig		1,070,000		[illegible]	--	--	--	
23	S2 to Air Preheater	274	30 psig		1,110,000		1,200	--	--	--	
24	S1 to HE-3H	379.5	180 psig		2,780,000		3,290	--	--	--	
25	Water to CE-1H	85				5GPM	--	--	--	--	
[illegible]	S2 to HE-7H	274	30 psig		905,000		980	--	--	--	
27	S1 to HE-7H	379.5	180 psig		250,000		298	--	--	--	

Specific gravity at operating temperature and pressure referred to water at 4° C. or air at 60°F. and 14.696 psia

(1) Air pressures refer to inches of water above or below atmospheric pressure

(2) Air volumes refer to 70° F. and 29.92 inches Hg. as standard; density 0.075 lb/ft³

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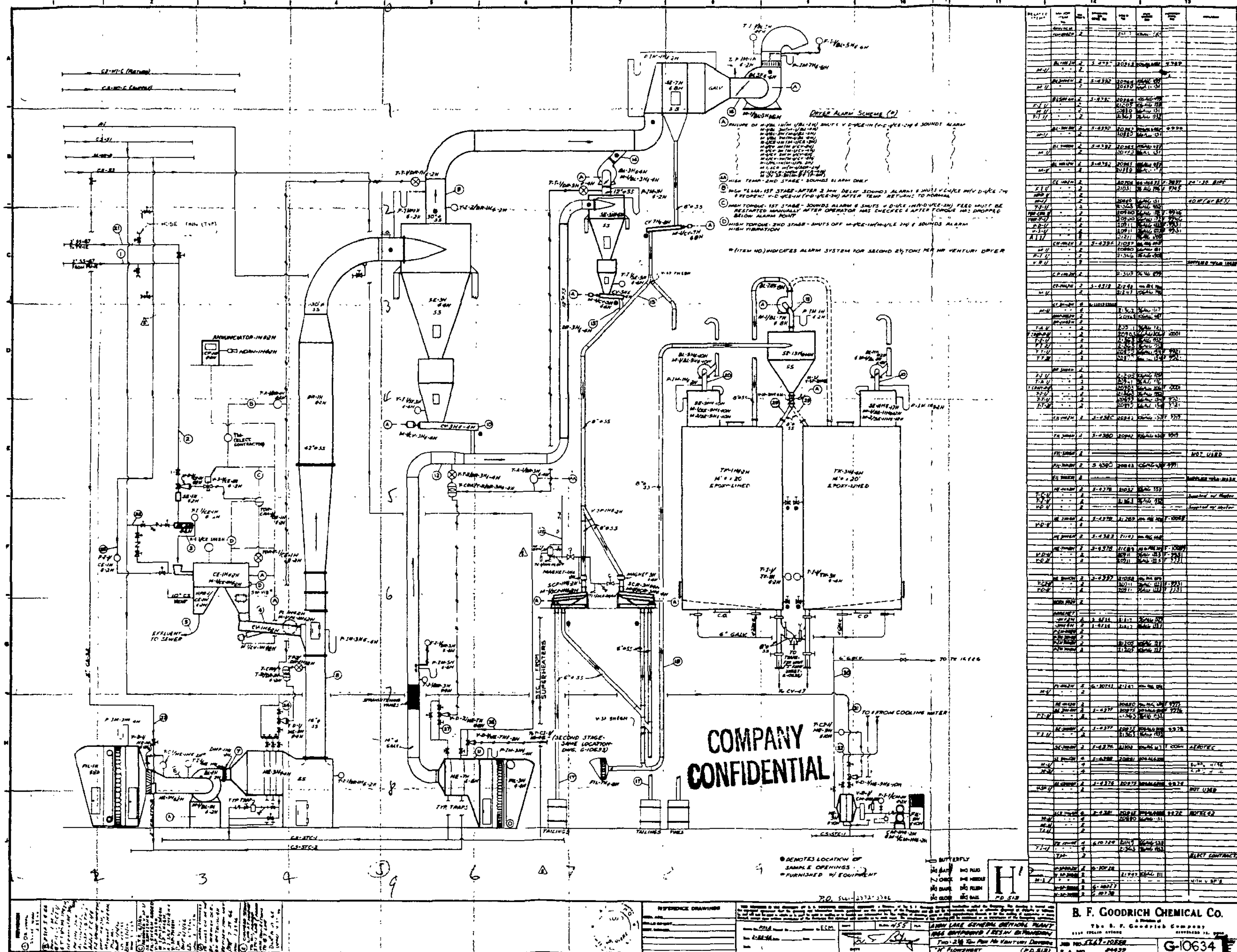
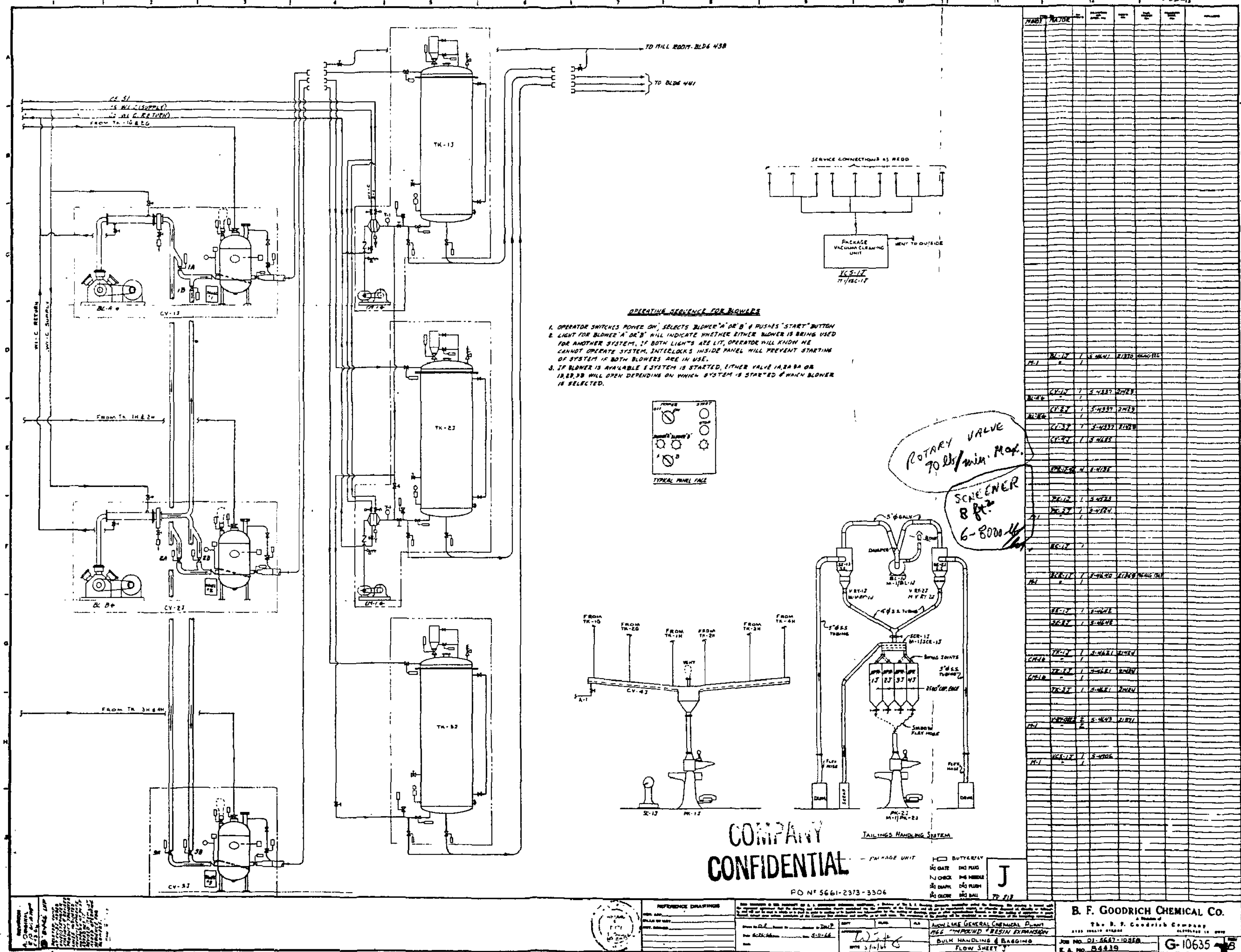
NGC35912

H - FLOWSHEET Issue A
AVON LAKE 1966 RESIN EXP. 5000#/hr. VENTURI (PD-513)

Made by ECM Approved [illegible] Job No.10558 Charge:2372

LOCATION		TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH TOTAL	PVG	WATER	AIR
[illegible]	S2 to Magnet 1H	274	30 psig				8	--	--	--
29	Product from Bins	100		30#/ft^3		166 CFH	5,004	4,969	34.8	--
30	Fluidizing Air to Bin	170	5.5 psig	15,878 ft^3/lb.		1,600 SCFM	7,200	--	--	7,200
31	S1 to HE-9H	379.5	180 psig		191,000		226	--	--	--
32	W1-C to HE-9H	85				25 GPM	--	--	--	--





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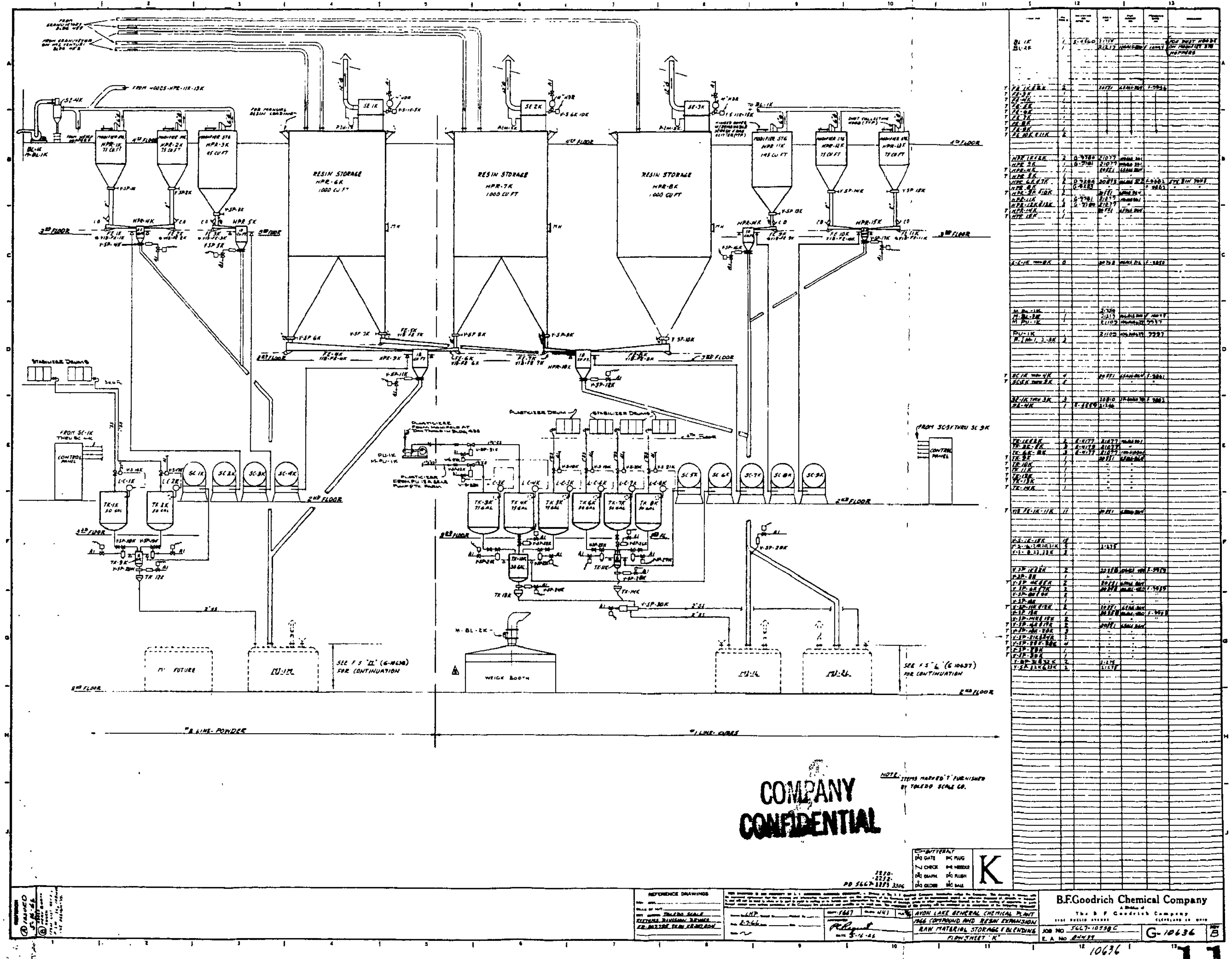

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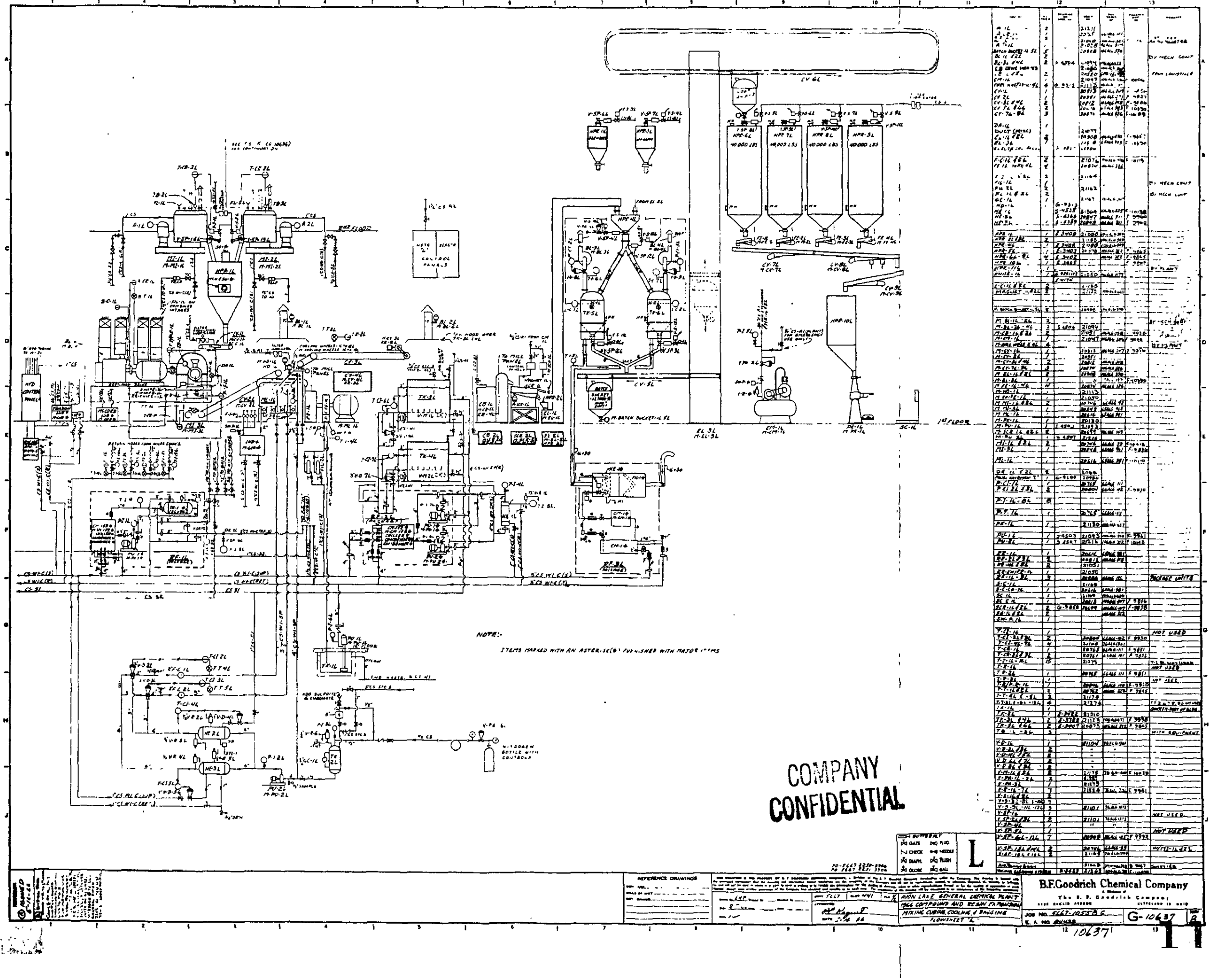

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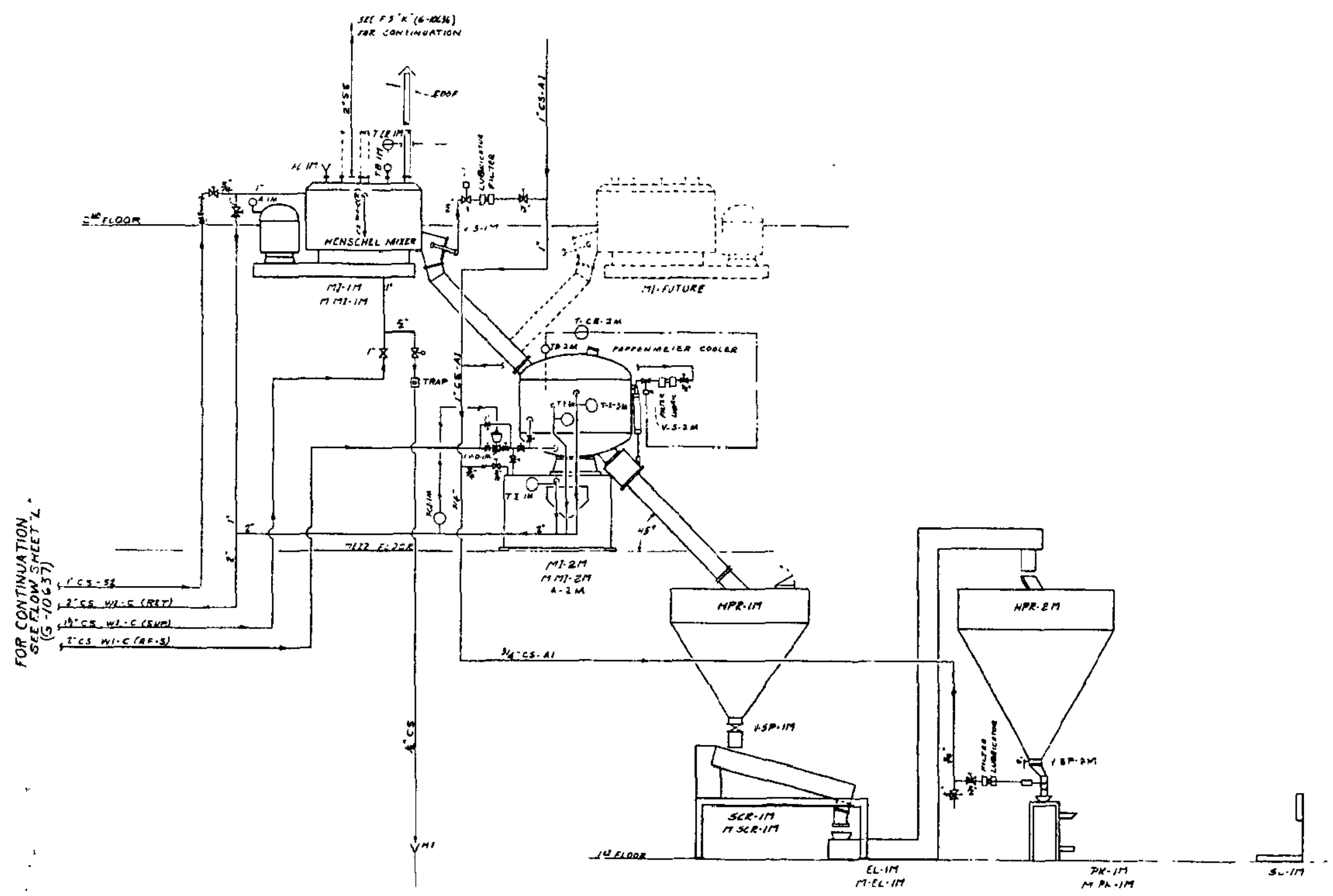

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A-1M	
A-1-1M	
EL-1M	1
FL-1M	1
HPR-1M	1
HPR-2M	1
M-EL-1M	1
M-M1-1M	1
M-M1-2M	1
M-PK-1M	1
M-SCR-1M	1
M1-1M	1
M1-2M	1
PK-1M	1
SC-1M	1
SCR-1M	1
MISCELLANEOUS	
STRUCTURAL STEEL	

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BUTTERFLY; GATE; PLUG; CHECK; NEEDLE; DIAPH.; FLUSH; GLOBE; BALL

M

REFERENCE DRAWINGS

5667 | 441 | AVON LAKE GENERAL CHEMICAL PLANT
1966 COMPOUND AND RESIN EXPANSION
POWDER MIXING, TRANSFER & BAGGING FLOW SHEET "M"

Date 5-6-66

B.F.Goodrich Chemical Company
A Division of The B. F. Goodrich Company
Cleveland, Ohio

JOB NO 5667-10538C
C.A. NO B4433
G-10638

10638

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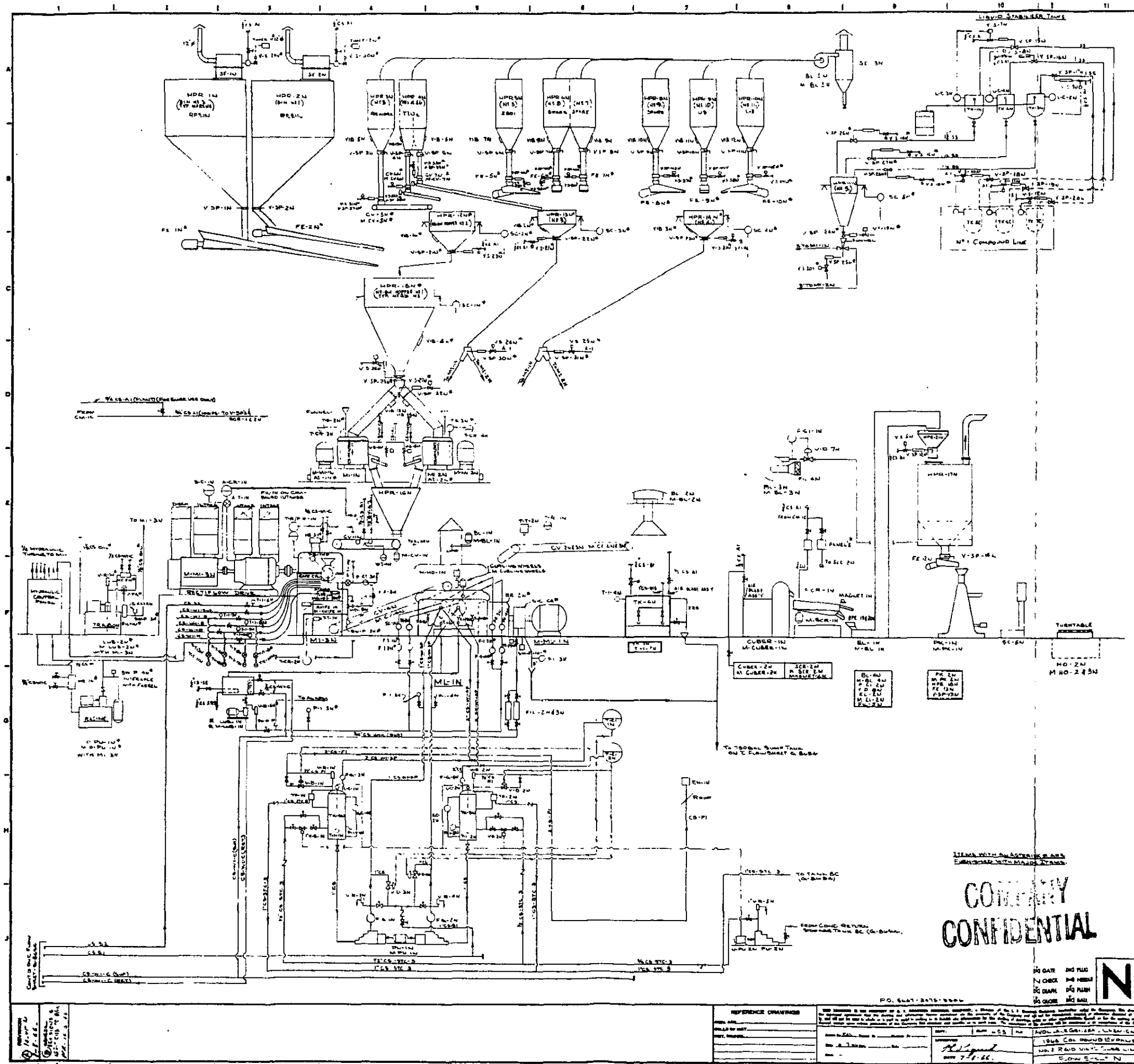

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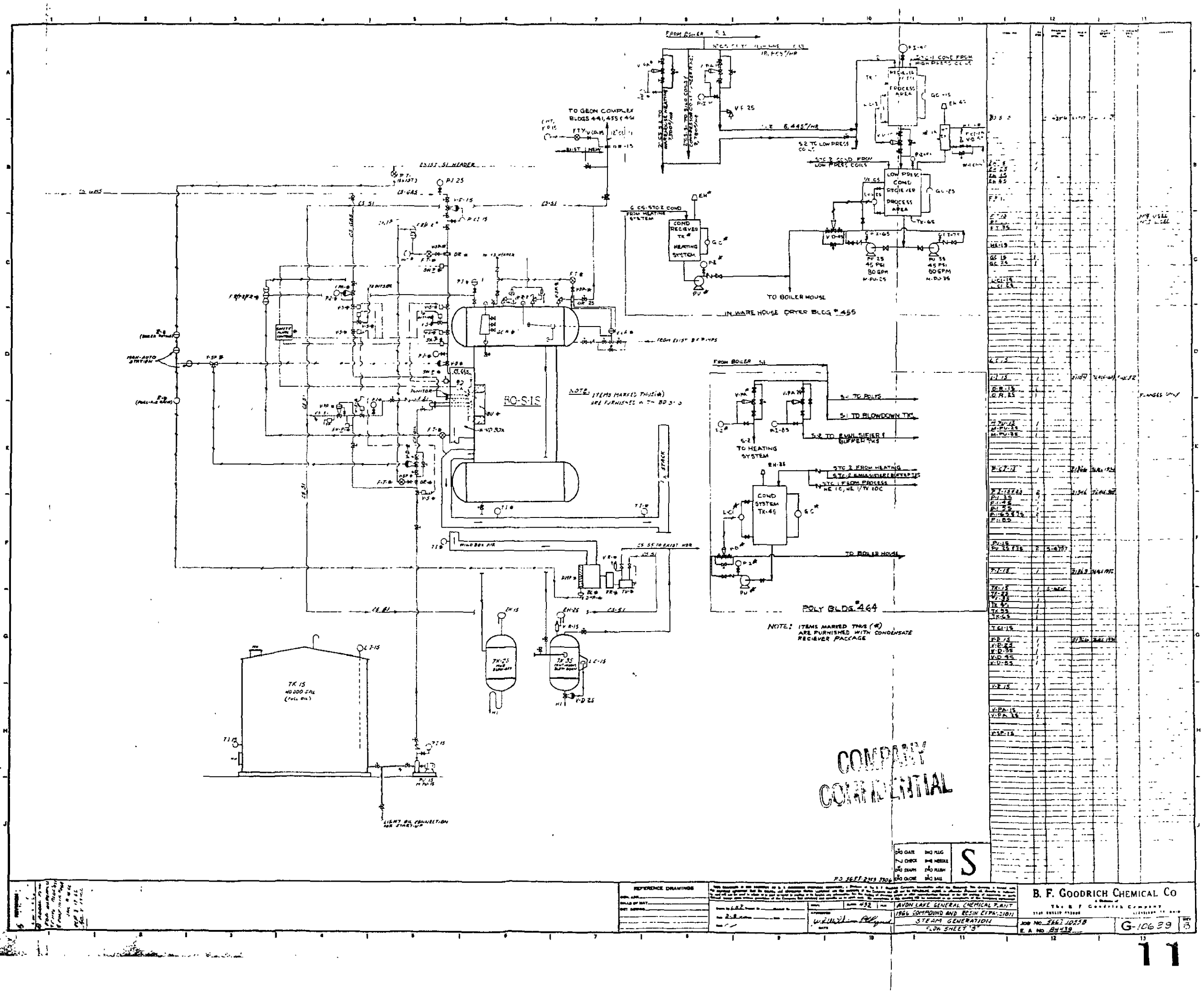

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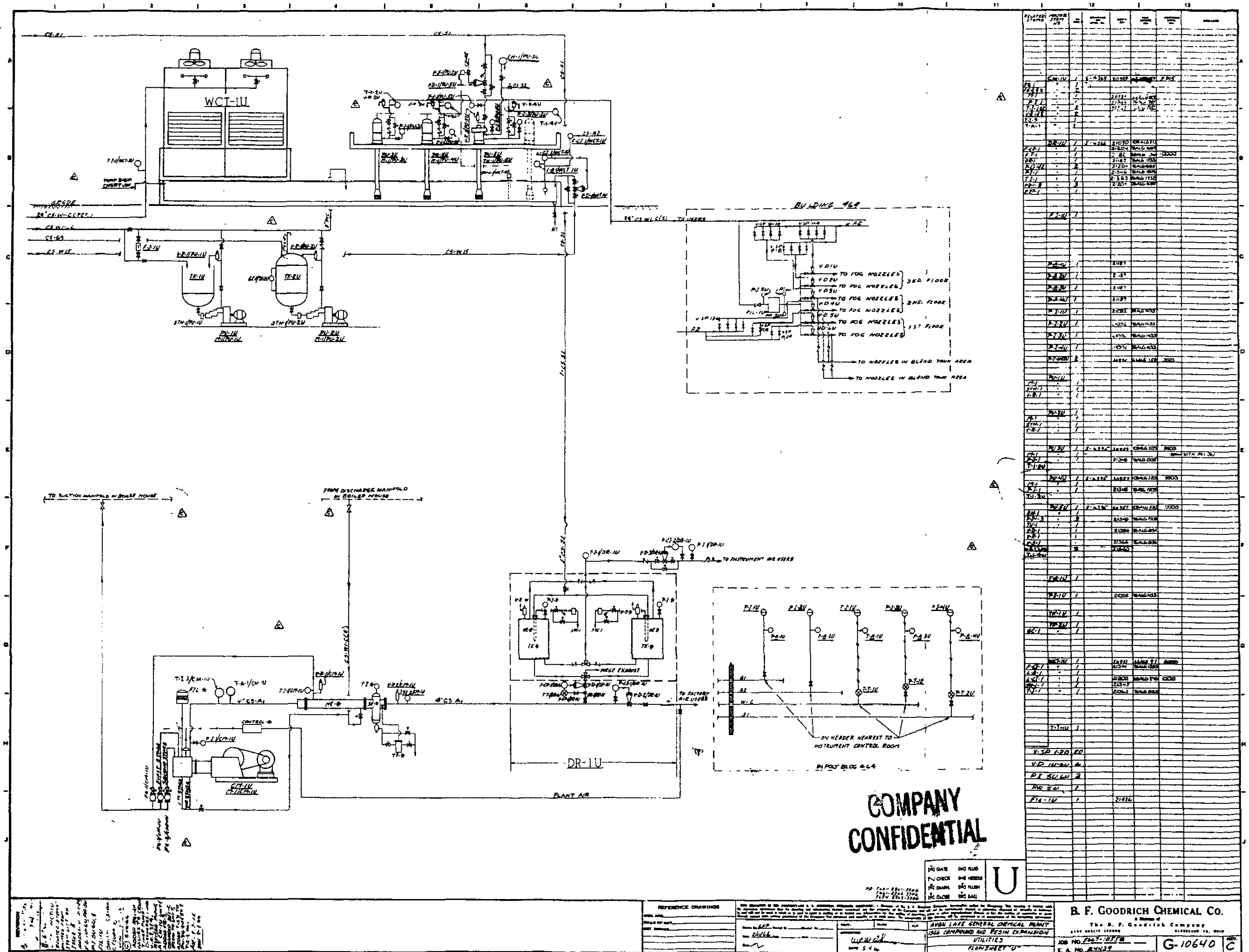

LOCATION	W - FLOWSHEET Issue A 1966 Avon Lake Compound & Resin Expansion	TEMP, DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER BATCH									
							TOTAL	City Water	FerriFloc	50% Caustic	Chlorine	Clarified Water	Filtered Water			
1	City Water to WS-1W	40		1.00	1.55	400 GPM	200,000	200,000								
2	FerriFloc Sol'n to WS-1W	70		1.00	1.00	8.2 GPH	68.64	61.78	6.86							
3	50% Caustic to WS-1W	70		1.525	115 cp	5.4 GPH	68.64			68.64						
4	Chlorine to Chlorinator	70				0.337 SCFM	2.00				2.00					
5	W-15 Water to Chlorinator	40		1.00	1.55	7.5 GPM	3,740	3,740								
6	Chlorinated Water to WS-1W	40		1.00	1.55 cp	7.5 GPM	3,742	3,740			2.00					
7	W-15 Water to TK-1W & 2W	40		1.00	1.55 cp	40 GPM	* 1,600.00	* 1,600.00								
8	Clarified Water to Storage	40		1.00	1.55 cp	400 GPM	200,000					200,000				
9	W-15-CL to Cooling Tower	40		1.00	1.55 cp	400 GPM	200,000					200,000				
10	W-15-CL to 1st Filter System	40		1.00	1.55 cp	400 GPM	200,000					200,000				
11	W-15-CL to 2nd Filter System	40		1.00	1.55 cp	400 GPM	200,000						200,000			

Made by VNA Job No. 10558-R
Approved GWS ELP JWC Charge: PD-513

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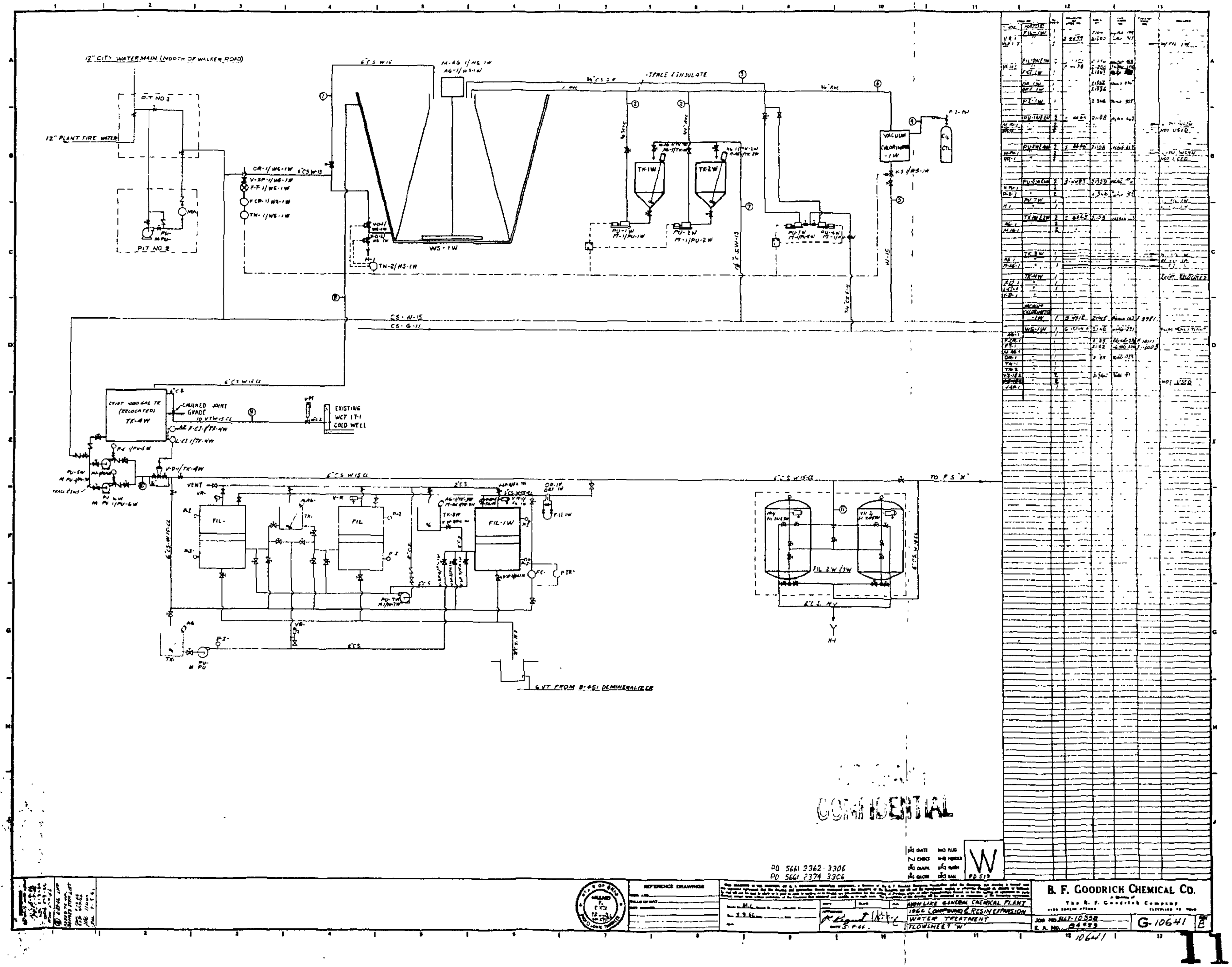
NGC35922



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NGC35923

0-513 Issue B X - FLOWSHEET Avon Lake 1966 Resin and Compounding Expansion	TEMP. DEG. F.	PRESSURE PSIG or MM Abs.	SPECIFIC GRAVITY	VISCOSITY cp or DUTY BTU/hr	VOLUME RATE	FLOW RATE, POUNDS PER HOUR OR *POUNDS PER REGEN. CYCLE — Made by GWS Approved ELP — Job No. DJ 1055B-R Charge: 2374								
						TOTAL	Clarified Water	Low Conductivity DM Water	High Conductivity DM Water	66°Be H_2SO_4	50% Caustic	Air	Steam	Cooling Water
Clarified Water to Demineralizer System	40°F	(B) 50 psig	1.0	1.5 cp	400 GPM Max. 258 GPM Ave.	200,000 MAX. 129,000 Ave.	200,000 Max 129,000 Ave							
Clarified Water to WS-1X Cation	40°F	(B) 39 psig	1.0	1.5 cp	200 GPM Max.(B) 160 GPM Ave.	100,000 Max(B) 80,000 Ave	100,000 Max(B) 80,000 Ave							
DM Water to Vacuum Degassifier	40°F	(B) 29"Hg.Vac	1.0	1.5 cp	400 GPM Max. 258 GPM Ave.	200,000 Max 129,000 Ave		200,000 Max 129,000 Ave						
DM Water to TK-1X	40°F	0 psig	1.0	1.5 cp	400 GPM Max. 258 GPM Ave.	200,000 Max 129,000 Ave		200,000 Max 129,000 Ave						
DM Water to Storage Sump	40°F	0 psig	1.0	1.5 cp	400 GPM Max. 258 GPM Ave.	200,000 Max 129,000 Ave		200,000 Max 129,000 Ave						
DM Water to B-451, B-452, & B-455, B-464 Flushing	40°F	100 psig	1.0	1.5 cp	200 GPM Inst. 87 GPM Ave.	100,000 Inst 43,500 Ave	Ave	100,000 Inst 43,400 Ave						
DM Water to B-455, B-464 Flushing	40°F	100 psig	1.0	1.5 cp	200 GPM Inst. 52 GPM Ave.	100,000 Inst 26,000 Ave		100,000 Inst 26,000 Ave						
DM Water to Mixed Bed Exchangers	40°F	50 psig	1.0	1.5 cp	330 GPM Max.(B) 171 GPM Ave.	165,000 Max(B) 85,500 Ave		165,000 Max(B) 85,500 Ave						
DM Water to TK-20C (B-464 Charging)	80°F	100 psig	0.998	0.85 cp	150 GPM Max. 67 GPM Ave.	75,000 Max. 33,500 Ave			75,000 Max 33,500 Ave					
66°Be Sulphuric Acid to WS-1X Cation Exchanger	70°F		1.8355	25 cp	1.0-4.0 GPM (B)	751 * (B)				751 * (B)				
50% Caustic to WS-1X Anion Exchanger	70°F		1.5253	100 cp	0.7 GPM (B)	268 * (B)					268 * (B)			
Steam to Vacuum Degassifier Steam Jet	377°F	175 psig		209,200 (B)	247 #/hr. (B)	247 (B)							247 (B)	
Cooling Water to Vacuum Degassifier Steam Jet	60°F	(B) 60 psig	1.0	1.2 cp	16 GPM (B)	8000 (B)								8000 (B)
66°Be Sulphuric Acid to WS-1X	70°F		1.8355	25 cp	0.4 GPM (B)	80.5 * (B)				80.5* (B)				
50% Caustic to WS-3X	70°F		1.5253	100 cp	0.5 GPM (B)	420 * (B)					420 * (B)			
Factory Air to WS-3X		80 psig			96 SCFM (B)	960 SCF*(B)						960 SCF (B)		
DM Water from Mixed Bed Exchangers	40°F	(B) 0 psig	1.0	1.5 cp	330 GPM Max(B) 171 GPM Ave.	165,000 Max(B) 85,500 Ave			165,000 Max(B) 85,500 Ave					
DM Water to B-464 Flushing	40°F	100 psig	1.0	1.5 cp	200 GPM Inst. 45 GPM Ave.	100,000 Inst 22,500 Ave		100,000 Inst 22,500 Inst						
DM Water to B-455 Flushing	40°F	100 psig	1.0	1.5 cp	200 GPM Inst. 7 GPM Ave.	100,000 Inst 3,500 Ave		100,000 Inst 3,500 Ave						
(B) DM Water to WS-3X	40°F	25 psig	1.0	1.5 cp	200 GPM Max. 160 GPM Ave.	100,000 Max 80,000 Ave			100,000 Max 80,000 Ave					
(B) DM Water from WS-3X	40°F	0 psig	1.0	1.5 cp	200 GPM Max. 160 GPM Ave.	100,000 Max 80,000 Ave			100,000 Max 80,000 Ave					

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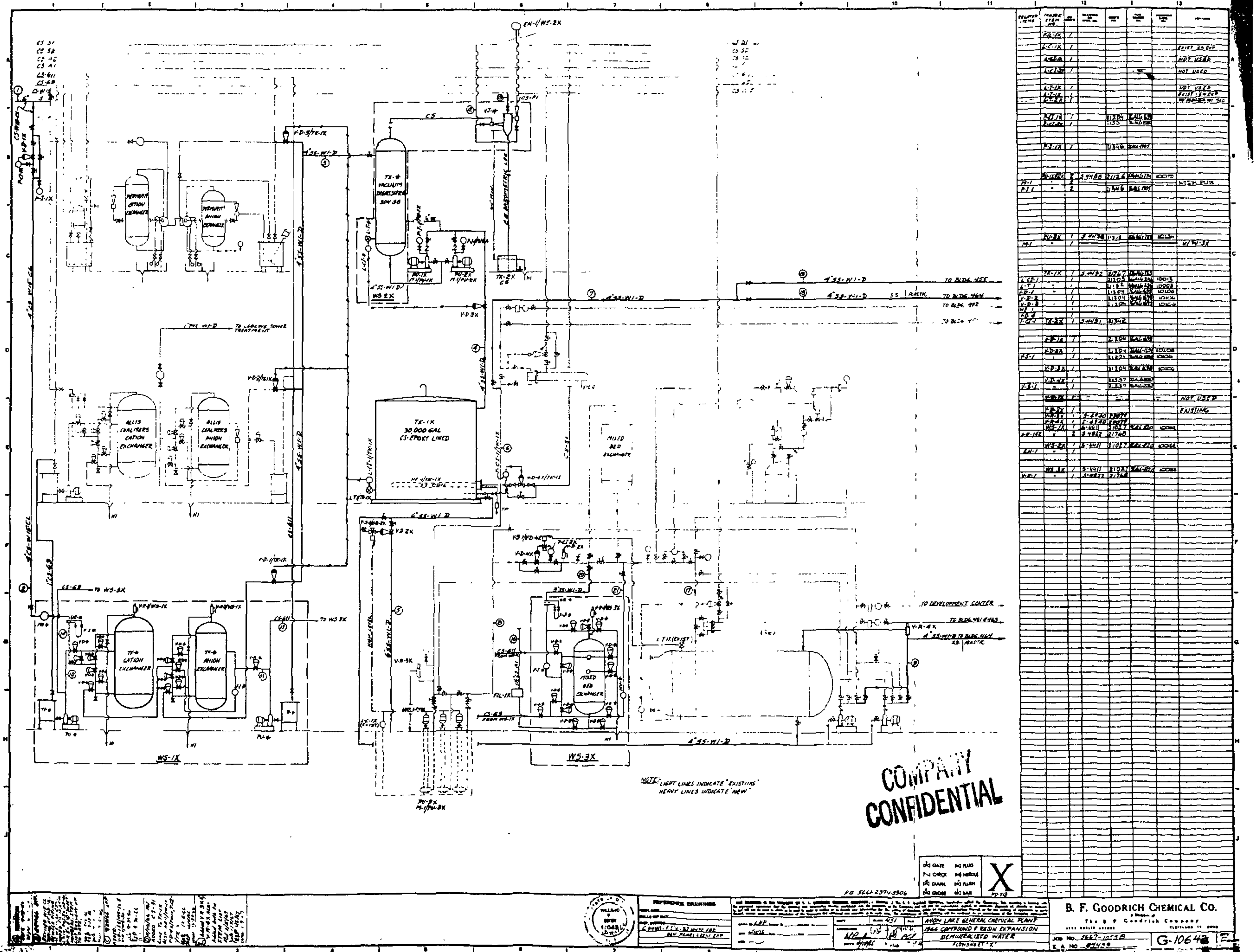
NGC35924



EQUIPMENT LIST

PU-11B-1 Vinyl Transfer Pump

Union Size 18x11x18 Duplex Valve pot, Class DVP steam pump, having DX-65-305 cast iron steam end, Ductile iron DX-65-305 pump end, hard steel cylinder liner, steel piston rods, Evans "X" steel liquid valves and Allen 840 W packing. Pump to deliver 400 gpm against 249 psig discharge pressure at piston speed of 45 RPM and 14.9 RPM. Complete pump with 1 qt. mechanical McCord lubricator.

All in accordance with our spec. S-4522 Revision B.

Spec. No. S-4522 Rev. B Reqn.No. 21421 P.O.No. 106-ALG-871 F.No. 10127

TK-16B-1 & 17B-1 Vinyl Surge Tanks on PU-16B-1 Discharge Line

Tanks constructed in accordance with B.F.Goodrich Drawing E-3459-A by The Thornton Company. Tanks are of 12" schedule 40 pipe with a 2' - 6" straight side and a capacity of 20 gallons each. Tank heads are 12" standard weight welding pipe caps. Design pressure 450 psig at 450°F.

Spec.No.E-3459-A Reqn.No. 22050 P.O.No. 107-ALG-34 F.No.

EQUIPMENT LIST

AG-1/TK-1C to TK-6C Agitator for 300 gallon Emulsifier Solution Tanks

Chemineer model VHB-10 top entering agitator, with two 5 inch diameter, 3 blade marine propellers on 1-1/4 inch diameter shaft. Lower propeller is located at tank bottom tangent line, upper propeller is located 10 inches above lower propeller. Shaft speed is 1750 RPM, direction of rotation is clockwise as viewed from the hinged cover and is indicated by an arrow on the agitator housing. All parts of agitator in contact with tank contents constructed of type 304 stainless steel. 1 HP, 1750 RPM, 440 volt, frame 182 explosion-proof, NEMA C flange mounted motor.

Spec. No. S-4372 Reqn.No. 20967 P.O.No. 106 ALG-485 F.No. 10087

AG-1/TK-10C to TK-12C Agitator for 300 gallon Emulsifier Solution Tanks

Lightning model NLDG-25 fixed mount mixer, with two 7.7 inch diameter, 3 blade marine propellers on 1 inch diameter shaft. Bottom propeller to have stabilizing ring. Shaft speed is 350 RPM, direction of rotation is clockwise as viewed from the top of the tank. All parts of agitator in contact with tank contents constructed of type 304 stainless steel. 1/4 HP, 1750 RPM, 440 volt, 3 phase, 60 cycle, Class I, Group D, explosion-proof motor.

Spec.No. 4505 Reqn.No. 21297 P.O.No. 106-ALG-790 F.No. 10171

CM-1C & HE-1/CM-1C Nitrogen Compressor package unit

Nitrogen compressor package unit. Unit to be composed of Gardner-Denver Model RLA, size 3-3/4" x 5" single cylinder, single stage, single acting, water cooled horizontal compressor, complete with suction unloading valves, Class 1, Group D high pressure dual control and low pressure alarm switch fabricated with Underwriters Laboratory approved components, complete v-belt drive, pressure lubrication of power end, forced feed mechanical lubricator for air cylinder, metallic packing and a pneumatic water control valve. Package to also include a size 36" x 96" ASME National Board approved and stamped vertical nitrogen receiver complete with fittings and base ring for vertical mounting and with a Model SAF-20-11 after cooler complete with separator. With the exception of vendors standard compressor material and omission of activated carbon filter cartridge back pressure regulator and pulsation dampener, all above in accordance with B.F.Goodrich Specification 4426 Issue B.

Motor to be supplied by B.F.Goodrich will be a 25HP, 1800 RPM unit with T-284 frame size.

Spec.No. 4426 Reqn.No. 21350 P.O.No. 106-ALG-848 F.No. 10135

FIL-1&2/TK-19C & 25C Recovered VCl Gas and Liquid Filters

Single Maxi-Flo Filters with ASME Code Stamp. All construction of 304 stainless steel. Design units for 125 psig at 200°F. Equip four (4) of your base units with 3" inlets and outlets, and two (2) of your base units with 4" inlets and outlet. Complete each unit with gauges and twelve (12) Auto-Spun elements with stainless steel core and 10 Micron rating--each element 10" long by 2½" diameter. All above in accordance with B.F.Goodrich specification S-4733B.

Spec.No. 4733 Rev.B Reqn.No. 21753 P.O.No. 106-ALG-1061 F.No. 10480

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HE-1C Deionized Water Heater

A Doyle and Roth Manufacturing Company model LLS 106U2-10.25H shell and tube exchanger with fixed tube sheets consisting of a 10-3/4" O.D. carbon steel shell containing 34-3/4" O.D. x 18 BWG 304 S.S. U-tubes 10.25 ft. long (per half U-tube) with 104 sq. ft. heat transfer surface. Tube pitch 15/16" triangular. Baffle spacing 24 in. Tube side 2 pass, nozzle sizes 3", 3" - 150 lb. ASA; shell side 1 pass, nozzle sizes 4", 3" - 300 lb. ASA.

Design: Tubeside - 100 lb. @ 380°F., shell side 250 lb. @ 400°F.

In accordance with ASME Code and BFG Chem. Spec. 4603 Issue C.

Spec.No. 4603 Rev. C Reqn.No. 21234 P.O.No. 106-ALG-755 F.No. 10126

HE-1/PU-3C & 4C Bypass Cooler for PU-3C & 4C

American Standard Size 204-6 EF heat exchanger, R/N 160M204-6A2 one pass horizontal shell and tube exchanger with fixed tube sheets consisting of a 2.375" O.D. carbon steel shell containing 14-3/8" O.D. x 20 BWG 316 stainless steel tubes 4' - 6" long with 6.17 sq. ft. heat transfer surface. Triangular tube pitch. Brass baffles with 2" spacing. Tubeside 1 pass, nozzle size 2", 2" FPT; shell side 1 pass, nozzle size 1/2", 1/2" FPT.

Design: Tubeside 1000 psi @ 850°F, Shell side 1000 psi @ 750°F.

Spec.No. 4412 Rev. B Reqn.No. 21413 P.O.No. 106-ALG-874 F.No. 10124

MH-SP-1/TK-20C Emergency Pressure Relief Vents

A Johnston & Jennings Company 18" Oceco V-108B Emergency Pressure Relief Vent set to relieve at 3 oz/sq. in., Aluminum body, Aluminum cover, Aluminum seat, Synthetic rubber diaphragm. Flange drilled 125# ASA Standard (16-1¼" diameter holes on 22-3/4" bolt circle).

Spec.No. 4734 Reqn.No. 21669 P.O.No. 76-ALG-2381 F.No. 10368

MV-1C & 2C Vinyl Chloride Charging Meters

A. O. Smith Model E3-S5 double case steel meter 300 lbs. rating. Connections: 3" 300 lb. flanges to measure flow of 100°F vinyl chloride up to 200 gpm. Trim: all iron. Complete with a steel set stop valve with all iron trim on discharge of meter, automatic temperature compensator, Class I, Group D, micro switch SPDT and a 3" 300 lbs. flange. Steel flow control valve with iron trim, also complete with counter-printer and set stop counter. Register calibration in gallons. Strainer body of cast steel with SS strainer. Flow limiting device provided to prevent flow from exceeding 225 gpm. Minimum flow for measuring: 50 gpm. Minimum temperature for measuring: 8°F. Accuracy ± 0.1 of 1%.

Reqn. No. 21023 P.O.No. 96-ALG-1135 F.No. 10055

MV-3C & 4C Hot Water Charging Meters

A. O. Smith 2" turbine meters with 300# ASA flanges. All wetted parts of stainless steel. Bearings of tungsten carbide sleeve design. Accuracy to be ± 0.2%. Range, 20-240 GPM linear; extended range 10-275 GPM.

A.O. Smith 1532-P Stepper Motor drive for receiving pulses from meter and driving motor. Stepper motor to drive calibrator and counter. Containing two switches, SPDT, for actuating solenoid valves. Class 1, Group D, 110/1.

Set stop counter with calibrator. Counter to read 9,999 gallons in increments of one gallon. Calibrator to provide direct reading gallons on counter.

Large numberal counters with ticket printer, cumulative model 581 digital to Analog Converter, range 1-5 ma. @ 12,000 ohms impedance.

Reqn.No. 21349 P.O.No. 96-ALG-1343 F.No. 10124

MV-5C Cold Water Meter for TK-1C, 4C & 10C

Neptune type S water meter for 125 psi working pressure with 1½" 125 pound flanged connection to measure water flow up to a maximum of 100 gpm. Normal flow is 75 gpm. Meter complete with strainer, flow control valve, and auto-stop valve.

Reqn.No. 21339 P.O.No. 96-ALG-1324 F.No. 10124

PU-1C & 2C Deionized Water Charging Pumps

Goulds Model 3196, size 1½ x 3-13, Group M, single stage pump 316 steel case, impeller, shaft and shaft sleeves. To deliver 200 gpm against 609' TDH. Pump to be complete with Falk coupling, coupling guard, Crane type 9BQP1C1 balanced mechanical seal with a recirculating line from the pump discharge to the stuffingbox. Pump to be mounted on bed plate. Frame 365TS, suitable for our 100 hp, 3500 rpm, 3/60/440, Class I, Group D motor.

Spec.No. 4436 Reqn.No. 21440 P.O.No. 96-ALG-1135 F.No. 10182

PU-3C & 4C Deionized Water Injection Pumps

Model 11SC2855-SA, end mounted, two stage, regenerative turbine pumps of 316 stainless steel construction. Each pump is to run continuously and deliver 31 GPM @ 902 feet TDH. Each unit shall include Falk T-31 coupling, coupling guard, steel base plate and John Crane type 9B balanced seal with internal flush. BFG will provide 25 HP, 3500 RPM, 440/3/60 Class 1, Group D motor, Frame #284TS for field mounting.

Spec.No. 4413 Reqn.No. 21282P.O.No. 106-ALG-794 F.No. 10185

PU-5C High Pressure Water Cleaning Pump

1-9/16" x 5" Union Series TX-200 Triplex Hydraulic Pressure Pump to deliver 45 GPM @ 6000 psig discharge pressure, pump to be com[illegible] with in-built speed reducer, McCord mechanical cylinder lubricator. [illegible]on Greer #A4894-200 accumulator, Waldron coupling & coupling guard, fabricated steel base plate, 200 HP, 1800 RPM, 440/3/60, Class 1, Group D, frame 447T motor.

Spec.No. 4508 Reqn.No. 21333 P.O.No. 106-ALG-836 F.No. 10295

PU-6C & 7C Recovered VCl Charging Pump

Goulds Model 3196-1½ x 3-13 centrifugal pumps, all wetted parts to be T316 stainless steel. Complete with Crane type 9 seal, Falk type T31 coupling, coupling guard and mounted on bedplate, to receive our 40 HP, 3500 RPM, 3/60/440 Class 1, Group D, frame 324TS motor.

Spec.No. 4421 Reqn.No. 21127 P.O.No. 106-ALG-841 F.No. 10143

RF-1C & 2C Catalyst Freezer

Catalyst Freezer, vertical type, explosion proof, double door, (magnetic latch type) with adjustable spark-proof shelves. Each freezer to store 24 cylindrical containers. Each container weighs 40 pounds, height 17 inches, diameter 12 inches. The freezer interiors are lined with 304 stainless steel. Each freezer interior dimensions follows: width - 52"; depth 25"; height - 58"; and two shelves spaced at 19" apart. The freezers exteriors will be painted galvanized.

Complete freezers with Class I, Group D, explosion-proof 1½ HP, 208/60/3 air cooled ref. unit, static-proof V-belt, remote bulb dial temperature gage (-40°F to + 100°F), explosion proof thermostat temperature controller, and one ½" NPT Port per freezer for customers temperature probe. The freezers are to [illegible] control over a +40° to -10°F range at 100°F ambient temperature.

Spec.No. 4421 Reqn.No. 21372 P.O.No. 106-ALG-873 F.No. 10172

STN-1/PU-5C High Pressure Pump Inlet Water Filter

Cuno Micro-Klean Filter Model 6AX-2 Cast iron and steel construction, 2" IPS connections, unit suitable for #2278-L1 Filter cartridges.

#2278-L1, 50 Micron, Micron-Klean Filter cartridges for above unit.

Spec.No._____ Reqn.No. 21696 P.O.No. 146-ALG-508 F.No. 9259

TK-1C to 6C & TK-10C to 12C Emulsifier Preparation Tanks

3' 6" O.D. x 4'4" straight side with sloping bottom head fabricated by Industrial Metal Products. Heating coil consists of approximately 50' of 1" Sch. 5 stainless steel pipe in six tube turns. Top cover: 11 ga., shell 3/16" thick, bottom head 3/16" thick. Bottom outlets: 1 - 3/4" 3000 lb. coupling for temperature controller. Side outlets: 1 - 1½" 150 lb. flange for drain. Top outlets: 1 - 5½" hole, 1 - 3-5/8" hole, and 2 - 1" openings for steam and condensate. Baffles: 2-3" wide x 3'9" long at 180°F. Bottom of tank slopes 1" per 21". Full volume: 300 gallon. Design: atmospheric pressure at 150°F. Exterior carbon steel sandblasted and painted with one coat of SW-74 to a minimum dry thickness of 1.5 mils.

Spec.No. 4372 Reqn.No. 21136 P.O.No. 106-ALG-666 F.No. 10068

TK-7C to 9C & TK-13C to 15C Emulsifier Charge Tanks

Emulsifier charge tanks 24" I.D. x 1'6" st. side, fabricated of 1/4" S.S. type 304 with 2:1 elliptical heads. Working pressure 250 psi @ 170°F. Full volume - 40 gallons. Fabricated by Brighton Corporation according to ASME Code, Part UW. All wetted type 304 stainless steel. Bottom outlets: 1-1½" 150 lb. lap joint for drain. Top outlets: 1-1½" 150 lb. lap joint flange for filling, 1-1½" 3000 lb. coupling for pressure inlet. Vessel is made with bracket for supporting tank from load cell.

Spec.No. 4371 Reqn.No. 21140 P.O.No. 106-ALG-686 F.No. 10291

TK-16C to 18C Catalyst Charging Bottles

12" I.D. x 21" stainless steel vessels fabricated by Superior Welding according to ASME Code, Part UM. Shell - 11 ga.; bottom head - 3/16" thickness. Cover is tube turn T-bolt hinged closure. All parts in contact with liquid or vapors of 304 SS. Design: 325 psig at 170°F. Carbon steel only sandblasted and painted with one shop coat of Dulux #773 primer. Stainless steel parts passivated. Estimated volume - 10 gallons. Bottom openings: 1 - 4" 300 lb. ASA nozzle for drain. Side openings: 1 - 4" 300 lb. ASA nozzle and 1 - 2" 300 lb. ASA nozzle for inlet and vent, respectively.

Spec.No. 4370 Reqn.No. 21139 P.O.No. 106-ALG-664 F.No. 10125

TK-19C & TK-25C Calibration Tanks

66" O.D. x 64" straight side carbon steel 304 SS clad vertical calibration tank with volume of 1000 gallons. ASME Code F & D heads have $\frac{1}{2}$" nominal thickness and cylindrical shell has $\frac{1}{2}$" total thickness. Design - 250 psig and full vacuum at 168°F. Fabricated by Brighton Corporation according to ASME Code, Part UW. Bottom openings: 1 - 18" manhole with 1-3" - 150 lb. lap joint outlet in manhole cover. Top side openings: 3 - 3" 150 lb. pads for inlet lines and 1 - 2" 150 lb. flange for N_2 line; top openings: 1-2" 150 lb. flange for relief. Tank has bracket for supporting tank from load cell.

Spec.No. 4369 Reqn.No. 21141 P.O.No. 106-ALG-686 F.No. 10289

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TK-20C Hot DM Water Storage Tank

20 feet I.D. x 18 feet straight side carbon steel storage tank with volume of 42,000 gallons. Fabricated in the field by General American Transportation Corporation according to A.P.I. Spec. 650. Heating coil consisting of 1" single turn U-tube 20 feet in length. Openings per B.F.Goodrich specification S-4384.

Spec.No. 4384 Reqn.No. 21267 P.O.No. 106-ALG-783 F.No. 10362

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TK-21C Emergency Seal Water Tank

3' I.D. x 3'2" straight side tank of 304 SS construction shell ½" thick, head 5/8" thick. ASME F & D heads. Fabricated by G.H. Hicks & Sons according ASME Code, Part UW. Bottom openings: 1 - 2" 300 lb. flange for drain. Side outlets: 2 - 3/4" 300 lb. flanges for sight glass, 1 - 4" 300 lb. flange for level control. Top side outlets: 1 - 3/4 300 lb. flange for relief connection, 1 - 1" 300 flange for N_2 line. Design - 300 psig and full vacuum at 200°F. Full volume - 200 gallons.

Spec.No. 4385 Reqn.No. 21142 P.O.No. 106-ALG-686 F.No. 10290

TK-23C, TK-26C & TK-27C Shortstop Charging Tanks

12 inch I.D. x 30 inch straight side tank of type 304 stainless steel construction, shell and ASME F & D head is 3/8" thick. Top head is a tube turn T-bolt hinged closure. Fabricated by G. H. Hicks & Sons, Inc. According to ASME Code, part UW. Bottom opening: 1 - 1 inch 300 lb. flange outlet. Top side openings: 1 - 1/2 inch 300 lb. nitrogen inlet and 1-1/2 inch 300 lb. flange for relief. Support brackets are located on the side 15 inches from top flange.

Spec.No. 4430 Reqn.No. 21395 P.O.No. 106-ALG-839 F.No. 10370

TK-24C Vacuum System Seal Tank

24" O.D. x 3'0" straight side carbon steel separator seal tanks. Shell thickness - 3/16" flat bottom thickness - 1/2". Capacity - 48 gallons to overflow outlet. Design - atmospheric pressure at 450°F. Bottom outlets: none. Side outlets; 1 - 1½" 3000 lb. coupling for drain, 1 - 3" 150 lb. flange for overflow line.

Spec.No. 4491 Reqn.No. 21261 P.O.No. 106-ALG-754 F.No. 10175

VJ-1C & 2C Polymerizer and Blowdown Tank Evacuation Jets

Ingersoll-Rang two-stage condensing ejectors units with barometric inter-condensers. Each unit sized to evacuate 700 CFM of air from atmospheric pressure to 2 inches of mercury and to hold 2 inches of mercury with a 13.5 lb. per hour leakage. The total pump down time should be approximately 27 minutes. Each unit to require 225#/hour steam flow at a minimum steam pressure of 175 PSIG and a water (85°F) flow rate to condenser of 8 to 10 GPM:

Each unit to consist of a 2MG-12 first stage ejector, a CC10 barometric inter-condensers and a $1\frac{1}{2}$ MF10 second-stage ejector.

Spec.No. 4437 Reqn.No. 21337 P.O.No. 96-ALG-1364 F.No._____

"D" FLOWSHEET

EQUIPMENT LIST

Agitators and Agitator Drives

AG-1/PLY-1D to PLY-15D Agitators for 4300 Gallon Polys

Glascote Products, Inc. glass-coated 48" diameter, 3-blade retreat curve impellers with split hub design to fit a 3" diameter stainless steel shaft. Each impeller to be fabricated from Type 304 stainless steel and coated with Glascote's No. 770 glass.

Reqn. No. 20970 P.O. No. 66 ALG 176 F. No. 9978

AG-1/PLY-16D Agitator for 5200 Gallon Polys

Glascote Products, Inc. glass-coated 54" diameter, 3-blade retreat curve impeller, 7½" wide with split hub design to fit a 3" diameter stainless steel shaft. Impeller to be fabricated from type 304 stainless steel and coated with Glascote's No. 770 glass.

Reqn. No. 21237 P. O. No. 86 ALG 261 F. No. _____

AG-1/PLY-16D (Alternate) Agitator for 5200 Gallon Poly

Two Glascote Products, Inc. glass-coated 50" diameter, 3-blade retreat curve impellers, 6" wide with split hub design to fit a 3½" diameter stainless steel shaft. Impellers to be fabricated from type 304 stainless steel and coated with Glascote's No. 770 glass. Top of impellers will be located 26" and 96½" from face of mounting flange.

Reqn. No. 21238 P.O. No. 66 ALG 308 F. No. _____

DRV-1/PLY-1D to PLY-16D Agitator Drives for 4300 Gallon Polys

Philadelphia Gear model PSE-2M size 14-400 bottom entering drive assembly with 4" diameter shaft projecting 28 " from face of mounting flange for one 48" diameter, glass-coated, retreat curve impeller. Direction of rotation is counter-clockwise as viewed from the manhead. Shaft speed of 150 RPM obtained by combination

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of 6.25 to 1 ratio spiral bevel gear reducer and V-belt drive. 60 HP, 1800 RPM, 440/3/60, Class I, Group D, frame 364T motor. John Crane type 8B double mechanical seal. All parts of drive in contact with tank contents constructed of type 304 stainless steel.

Reqn. No. 20918 P.O. No. 66 ALG 88 F. No. _____

DRV-1/PLY-16D Agitator Drive for 5200 Gallon Poly

Philadelphia Gear model PSE-2M size 17-400 bottom entering drive assembly with 4" diameter shaft projecting 29½" from face of mounting flange for one 54" diameter, glass-coated, retreat curve impeller. Direction of rotation is counter-clockwise as viewed from the manhead. Shaft speed of 133 RPM obtained by combination of a spiral bevel gear reducer and a V-belt drive. 75 HP, 1800 RPM, 440/3/60, Class I, Group D, frame 365T motor. John Crane type 8B double mechanical seal assembly. All parts of drive in contact with tank contents constructed of type 304 stainless steel.

A spare 4" diameter output shaft projecting 96½" from face of mounting flange for two 50" diameter, glass-coated, retreat curve impellers. Upper keyway to be 3" in diameter with center line of keyway located 93" from face of mounting flange. Lower keyway to be located 26" from face of mounting flange to center line of keyway. An extra set of sheaves are provided to operate spare shaft at 125 RPM.

Reqn. No. 20918 P.O.No. 66 ALG 88A F. No. _____

DRV-1/TK-1D & TK-6D Agitator Drives for 9000 Gallon Blowdown Tanks

Chemineer Model MNP-75-426 top entering agitator drive with 3½" diameter shaft projecting 214" from face of mounting flange for two 42" diameter 4 pitched blade turbines, bottom turbine with stabilizer ring. Bottom impeller located 192" from face of mounting flange and top impeller located 107" from top of mounting flange. Direction of rotation is counter-clockwise as viewed from the manhead. Shaft speed is 68 RPM obtained by helical gear reducer. 7½ HP, 1750 RPM, 3 phase,

60 cycle, 230/460 volt, frame 213T foot mounted, explosion proof motor. John Crane type 9, double mechanical seal assembly. All parts in contact with tank contents constructed of type 304 stainless steel.

Spec. No. 4408 Reqn. No. 21105 P.O. No. 106 ALG 620 F. No. 10070

DRV-1/TK-2D to TK-5D Agitator Drives for 6000 Gallon Blowdown Tanks

Chemineer Model MNP-50-326 top entering agitator drive with 2-3/4" diameter shaft projecting 162" from base of mounting flange for one 40" diameter 4 pitched blade turbine. Direction of rotation is counter-clockwise as viewed from manhead. Shaft speed of 68 RPM obtained by helical gear reducer.5 HP, 1750 RPM, 3 phase, 60 cycle, 230/460 volt, foot mounted frame 184T, explosion proof motor. John Crane type 9, double mechanical seal assembly. All parts in contact with tank contents constructed of type 304 stainless steel.

Spec. No. 4409 Reqn. No. 21105 P.O. No. 106 ALG 620 F. No. 10071

Blowers

BL-1D Polymerizer Exhaust Blower

Clarage No. 111 type XL Fan, Class "C" Spark resistance SW-SI in Arrangement No. 9, Design 15-300, Open type wheel with flanged inlet and outlet, brass blades and brass spider, B.F.Goodrich static proof V-belt and sheaves. Frame suitable for customers 5 HP, Frame 184T, 1800 RPM, 3/60/440, Class I, Group D explosion proof motor.

Spec. No. 4493 Reqn. No. 21132 P.O. No. 106 ALG 674 F. No. 10174

Heat Exchangers

HE-1/PLY-1D to PLY-16D and HE-1/TK-1D to TK-6D Oil Pressure Units for Polymerizers and Blowdown Tank Drive Mechanical Seals

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The double mechanical shaft seals on the polymerizer and blowdown tank agitator drives must be supplied with an oil lubricant. The lubricant must be supplied at a pressure greater than the vessel pressure and must be cooled to remove the heat created by friction of the rotating seals. The oil pressure units are Pfaudler

Assembly 1312512 pressure lubricator assemblies consisting of a finned aluminum chamber with piping connections to and from the seal, [illegible] connection for applying pressure to the system and a hand pump for charging oil to the system. The oil is circulated by natural convection, cold oil from the chamber flowing by gravity into the seal and displacing the hot oil back into chamber where it is cooled.

Reqn. No. 20363 P.O. No. 106 ALG 360 F. No. See 8945

MH-SP-1/PLY-1D to PLY-16D Polymerizer Manhead Covers

18" Lenape style QODS quick opening door with all parts in contact with vessel contents fabricated of 304 SS and having a 32 RMS surface finish at the gasket surface and a 125 RMS on othersurfaces. Closures have design pressure of 300 psig. and full vacuum at 300°F. Six grease fittings are provided in frame hinges, cover hinges and links for proper lubrication of hinge pin and cam shaft. Cam shaft and cam shaft extension of hardened steel. These manhead covers do not have a sight glass opneing. Cam shaft designed to provide a minimum cover opening if latch handle is accidently operated with pressure in vessel. "O" ring gasket - 18" I.D. x 0.29", Durometer viton.

Reqn. No. 20778 P. O. No. 106 ALG 337 F. No. 9902

PLY-1D-15D 4300 Glass-lined Polymerizers

Glascote 4300 gallon closed, jacketed glass-lined reactors, 90" I.D. x 126" straight side.

Bottom Openings: 1 - 4¼" flanged (300 lbs) off center bottom outlet for bottom valve, 1 - 8" modified pad type (300 lbs. integral drilling) for agitator. Both of above located within a common jacket diaphragm type sealer. 2 - 5¼" flanged openings for the baffles, each opening in a separate jacket diaphragm type sealer. 8" agitator opening is Inconel faced and machined.

Shell Openings: 1 - 3" 300 lb. flanged opening located in the liner straight shell through a jacket diaphragm type sealer.

Top Head Openings: 6 - 4" 300 lb. flanged openings, 1 - 18" 300 lb. manhole with necessary "C" clamps for attachment of lenape quick opening manhead to nozzle. Manway flange is Inconel faced and machined flat after vessel is glassed.

Jacket Openings: 14 - 3" IPS 3000 lbs. couplings, four having 3" size agitating nozzle assemblies, 1 - 2" 150 lb. flanged connection, 1 - 4" 150 lb. flanged connection, 1 - 3/4" 3000 lb. coupling, and 1 - $\frac{1}{4}$" 3000 lb. coupling with brass petcock for jacket vent.

Glass: All inner surfaces glass-lined with acid-alkali resisting chemical glass #772. Tested with 5000 volt test at Glascote and plugged with gold plugs.

Pressure: Vessel designed to withstand 300 lbs. internal pressure or full vacuum. Jacket designed for 60 lbs. working pressure coincident with full internal vacuum. Design temperature - 300 °F.

Gaskets: Lead sheathed asbestos gaskets for all glass-lined nozzles except manway nozzle.

Finish: Exterior surfaces sandblasted and painted with one shop coat of modified epoxy resin primer. Top head circumferential weld on 18" opening fully radiographed. Other welds spot radiographed. Split flanges fabricated ofsteel. Vessel design and fabrication complies with 1962 ASME unfired pressure vessel code.

Baffles: Glascote 5" - 300 lb., glass-coated, water cooled, fixed type. Baffle assembly 159" long overall after flattening. Cross-sectional dimensions after flattening - 3" x 9". Inlet and outlet water connections are 1" N.P.T. Length of baffle from bottom of blade to 6" x 4" eccentric reducer - 126".

Reqn. No. 20707 P.O. No. 66 ALG 70 F. No. 9980

PLY-16D 5200 Gallon, Glass-lined Polymerizer

Glascote 5200 gallon closed, jacketed glass-lined re[illegible] 96" x 135" straight side.

Bottom Head Openings: Same as PLY-1D to PLY-15D

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Top Head Openings: Same as PLY-1D to PLY-15D

Shell Openings: Same as PLY-1D to PLY-15D

Jacket Openings: Same as PLY-1D to PLY-15D with the following exceptions:

a. Increase the number of 3" 3000 lb. agitating nozzle coupling from 4 to 5 with 3" agitating nozzles set for clockwise flow and having renewable wear plates.

b. Increase jacket outlet from 4" to 6" 150 lb. flange.

Glass: All inner surfaces glass-lined with acid-alkali resisting chemical glass #772. Tested with 5000 volt test at Glascote and plugged with gold plugs.

Pressure: Vessel designed to withstand 300 lbs. internal pressure or full vacuum. Jacket designed for 60 lbs. working pressure coincident with full internal vacuum. Design temperature - 300°F.

Gaskets: Same as PLY-1D to PLY-15D

Finish: Same as PLY-1D to PLY-15D

Baffles: Glascote 5" - 300 lb., glass-coated, water cooled, fixed type. Baffle assembly 169 inches long overall after flattening. Cross sectional dimensions after flattening - 3" x 9". Inlet and outlet water connections are 1" N.P.T. Length of baffle from bottom of blade to 6" x 4" eccentric reducer - 137".

Reqn. No. 20707 P.O. No. 66 ALG 70 F. No. 9977

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PU-1D to PU-4D Blowdown Tank Slurry Transfer Pumps

Goulds Model 3196, size 3 x 4 - 8G, Group S, 1 stage centrifugal pump with wetted portions of 316 SS construction. Complete with Crane type 9 QPICI mechanical seal with neoprene lipseal, flange ratings - 150 lbs. ASA. Shaft packing - Teflon. Will deliver 225 GPM of 150°F slurry at 48 feet TDH. At rating, BHP - 4.7, efficiency - 67%. Maximum BHP - 5.5. Impeller diameter - 7¼". Minimum/maximum impeller diameter, 5½/8 3/8. Rotation: right hand viewed from coupling end. NPSH available. - 5.7'. NPSH required - 3.8'. Pump driven by a 5 HP, 1750 RPM, 440 volt, 60 cycle, 3 phase, explosion proof, frame 184T motor.

Spec. No. 4407 Reqn. No. 21128 P. O. No. 106 ALG 774 F. No. 10078

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PU-5D Poly Cooling Water Return Pump

Goulds Model 3196, size 3 x 4 -8S, one stage centrifugal pump with wetted portions of 316 SS construction. Complete with Crane type 9 QPICI mechanical seal. Flange ratings - 150 lbs. ASA. Shaft packing - Teflon. Will deliver 300 GPM of 100°F water at 43 feet TDH. At rating, BHP - 4.6, efficiency - 71%, Maximum BHP - 5.8. Impeller diameter - 6-7/8". Minimum/maximum impeller diameter - 6"/ 8-3/8". Rotation: right hand viewed from coupling end. NPSH available - 22 feet. NPSH required - 5 feet. Pump driven by a 7½ HP, 1750 RPM, 440 volt, 3 phase, 60 cycle, explosion-proof, frame 213T motor.

Spec No. 4490 Reqn. No. 21330 P.O. No. 106 ALG 841 F. No. 10142

STN-1/PU-1D to PU-3D PVC Slurry Strainers

18" O.D. x 3'3" straight side slurry strainer of 304 stainless steel construction. Shell thickness - 1/8"; bottom head thickness - 3/16". Top head is a Tube Turns T-bolt closure. Design - 175 psig & full vacuum at 200°F. All nozzles - 150 lb. ASA rating. Full volume - 46 gallon. Gaskets - "O" rings with T-bolt closure. Strainer screen - 4 mesh x 18 BWG on end and inside frame. Fabricated by Superior Welding Co. according to ASME Code, part VW.

Spec. No. E-4132 Reqn. No. 21161 P.O. No. 106 ALG 684 F. No. 10140

TK-1D & TK-6D 9000 Gallon Blowdown Tanks

10'0" I.D. x 12'5" straight side, stainless steel, clad vertical blowdown tanks fabricated of 15% nominal 304 stainless steel cladding on A-212 Grade B, carbon steel backing. ASME Code elliptically dished heads with 3/4" total thickness. Cylindrical shell 13/16" total thickness. Capacity 9014 gallon. Design allowable working pressure - 196 psi and full vacuum at 300°F.

Bottom openings: 1 - 1½" nozzle for thermometer, 1 - 2" nozzle for steam inlet, and 1 - 4" opening for drain. Nozzles rated - 150 lb. ASA.

Side openings: None.

Top Head openings: 1 - 18" manhead with 2 - 4" sight glasses, 1 - 12" 150 lb. ASA mounting flange for agitator, 6 - 4" 150 lb. ASA nozzles. Included inside are

3 - 6" x ¼" x 12'4" baffles equally spaced and set out 3" from wall. Inside finish - #80 grit. Outside finish - sandblasted and painted with one coat zinc chromate iron oxide metal primer to a dry film of 1.5 mils. Fabricated by Process Engineering Inc.

BFG Dwg. E-4126-B Reqn. No. 20931 P.O. No. 66 ALG 144 F. No. 10091

TK-2D to TK-5D 6000 Gallon Blowdown Tanks

9'6" O.D. x 8'4" straight side, stainless steel, clad vertical blowdown tanks fabricated of 15% nominal 304 stainless steel cladding on A-212 Grade B, carbon steel backing. ASME Code elliptically dished heads with 5/8" total thickness. Cylindrical shell 3/4" total thickness. Capacity 6020 gallon. Design allowable working pressure - 200 psi and full vacuum at 300°F.

Bottom openings: 1 - 1½" nozzle for themometer, 1 - 2" nozzle for steam inlet, and 1 - 4" opening for drain. Nozzles rated - 150 lb. ASA.

Side openings: None.

Top Head openings: 1 - 18" manhead with 2 - 4" sight glasses, 1 -12" 150 lb. ASA mounting flange for agitator, 4 - 4" 150 lb. ASA nozzles. Included inside are 3 - 6" x ¼" x 8'4" baffles equally spaced and set out 3" from wall. Inside finish #80 grit. Outside finish - sandblasted and painted with one coat zinc chromate iron oxide metal primer to a dry film of 1.5 mils. Fabricated by Process Engineering Inc.

BFG Dwg. E-4127-B Reqn. No. 20931 P.O.No. 66 ALG 166 F. No. 8975

TK-7D Spray Ring Water Collector Tank

42" O.D. x 6'0" straight side carbon steel tank fabricated by Industrial Metal Products Co.. Bottom head is an ASME Code flanged and dished head of ¼" thickness. Shell is ¼" total thickness. Top cover bolted to shell is constructed of 11 gage steel and has a hinged opening. Capacity - 485 gallon. Design allowable working pressure - atmospheric at 150°F.

Bottom Openings: 1 - 4" 150 lb. ASA nozzle.

Shell Openings: 1 - 1½" nozzle for level control, 1 - 4" nozzle for recycle inlet, and 1 - 4" nozzle for overflow. Flanges are rated at 150 lb. ASA.

Top Openings: 2 - 8" diameter holes cut in top. Tank has 4 - 3" couplings welded to bottom head for 3/4" pipe legs. Inside finish - remove mill scale and rust by sandblasting. Outside finish - sandblasted and painted with one coat zinc chromate iron oxide metal primer to a dry film of 1.5 mils.

Spec. No. 4494 Reqn. No. 21393 P.O. No. 106 ALG 838 F. No. 10128

EQUIPMENT LIST

BL-1/TK-1E to TK-6E Blend Tank Exhaust Blower

Buffalo Forge Size 245 Arrangement 9, Class II BL fan of spark proof construction. Steel housing has six coats air dried vinyl coating (Bisonite M) applied to interior after sandblasting. Fan complete with flanged inlet and outlet connections, drain and V-belt drive.wheel and motor base of cast aluminum. Capacity - 1660 SCFM with 5 inch W.G.static pressure at 1.8 BHP and impeller RPM of 3030. Driven by a 2 HP, 1800 RPM, 440/60/3, Class I, Group D, frame 184 motor.
Spec. No. 4405 Reqn. No. 21024 P.O.No. 106 ALG 553 F. No. 10366

DRV-AG-1/TK-1E to TK-6E Blend Tank Agitators and Agitator Drives

Chemineer Model SAG-200-342 Side-Entering drive assembly with a $2\frac{1}{2}$" diameter shaft projecting 31" from face of mounting flange to bottom of 24" diameter square pitch right hand pitch marine propeller. Drive also complete with six ring packing gland with lantern ring, water flush chamber and lipseal, spring loaded automatic lubricator, 12" 150 lb. ASA mounting flange and pipe leg support.
Rotation: Counterlockwise as viewed from drive end.
All wetted parts of 304 stainless steel construction. 420 RPM shaft speed obtained by combination of gear reducer, and Falk flexible coupling connected to a 20 HP, 1750 RPM, 440 volt, 60 cycle, 3 phase, Class I, Group D, explosion-proof, Standard Float Mounted, Frame 256T motor. BHP 17.1.
Spec. No. 4404 Reqn. No. 21156 P.O. No. 106 ALG 707 F.No. 10288

FIL-1/TK-1E to TK-6E Blend Tank Vent Filters

Air-Maze 22MSEX1 Multi-Maze Filters with all-weather hoods and 12" 125 lb. ASA flange bases. Capacity - 2250 CFM. Resistance - 3" W.G. at 2250 CFM. Screen filter of oil wetter type. Can be washed in cleaning solution and reused.
Reqn. No. 20849 P.O. No. 96 ALG 710 F. No. 9896

PU-1E to PU-4E Dryer Feed Pumps

Goulds Model 3196, size 2 x 3-13, Group M, Centrifugal pump of 316 stainless steel construction. Service - PVC Slurry. Rotation: Right hand as viewed from drive end. Complete with Crane Type 9QPICI mechanical seal with neoprene lipseal, Falk Type T-31 coupling, coupling guard and bedplate. TDH - 184'. GPM - 120. NPSH available - 22.3'. NPSH req'd for pump - 2'. Pumping temperature 100°F. Pump efficiency 41%. BHP at rating - 15.2. Maximum BHP at bid diameter 25. Impeller bid diameter - 13". Min/Max diameter: 9"/13". Driven by a 20 HP, 1750 RPM, 440 volt, 60 cycle, 3 phase, explosion proof, frame 256T motor. Impeller speed 1750 RPM.

Spec. No. 4410 Reqn. No. 21148 P.O. No. 106 ALG 774 F. No. 10130

STN-1/TK-1E to TK-6E Blend Tank Strainers

See TK-1E to TK-6E

TK-1E to TK-6E Slurry Blend Tanks

16'0" I.D. x 13'8" high 304 stainless steel tanks per BFG Drawing G-10708, Rev. B. Volume - 19,600 gallon. Partially shop fabricated by Youngstown Steel Tank Co. Fabrication in accordance with API 650. Vessel constructed with 3/16" thick heads and shell, and ¼" thick bottom plates. Design pressure - atmospheric and 2" W.G. vacuum @ 70°F. Tank base slopes 1.3" per foot towards outlet nozzle and is made of concrete. Basket strainers, STNS-1E to 8E, made to fit into manhole to catch lumps in slurry. Basket size - 1' 9½" I.D. x 2'0" minimum length. 4 x 4 x .063 wire mesh screen.

Strainer nozzles: 4 - 4" 150 lb. ASA nozzles for slurry inlet.

Top openings: 1 - 16" 150 lb. ASA blower vent nozzle, 1 - 3" 150 lb. ASA slurry inlet nozzle, and 1 - 12" 150 lb. ASA air filter vent nozzle.

Side openings: 1 - 3" 150 lb. ASA slurry outlet nozzle, 1 -2" 150 lb. ASA air inlet nozzle, 1 - 12" 150 lb. ASA agitator nozzle, & 1 - 18" 150 lb. ASA manhead with cover.

Spec. No. G-10708 Reqn. No. 21074 P. O. No. 106 ALG 546 F. No. _____

"F" FLOWSHEET

EQUIPMENT LIST

AG-1/SE-1F to SE-3F & SE-6F Agitators for Foam Knock-Out Tanks

Chemineer model VHN-10 direct drive type agitators to mount on 8"-150 # ASA flanged nozzle. Shaft 1-3/8" diameter by 49" long with a 5" diameter propeller driven with a 1 HP, 1750 RPM, 3 phase, 60 cycle, 220/440 volt, Class I, Group D, explosion proof, frame 182C motor. Shaft supplied with a Crane #9B double mechanical seal with ceramic to carbon faces and lip seal and water flush cavity. All wetted parts to be 304 stainless steel construction.

Spec. No. S-4427 Reqn. No. 20930 P.O. No. 106ALG-455 F. No. 10069

CM-1F & CM-3F First Stage Vacuum Pumps

Nash CL-702 vacuum pump in bronze fitted construction complete with the following: inlet and discharge manifold, John Crane Type 8B2 balanced flushed mechanical seals and V-belt drive, 1770/980 RPM, B.F.Goodrich hi-capacity static conducting V-belts. Pump driven by 40 HP, 1800 RPM, 3/60/440 volt, Class I, Group D, explosion proof, frame 324T motor.

Spec. No. S-4355 Reqn. No. 21085 P. O. No. 106 ALG 536 F. No. 10308

CM-2F & CM-4F Second Stage Recovery Compressors

Nash size H-6 of bronze fitted construction complete with the following: John Crane type 8B2 balanced flushed mechanical seals, Falk coupling, non-sparking coupling guards, and 20" x 60" separator (SE-1/CM-2F & CM-4F) made to ASME specifications and including Jerguson gauge glass. Compressors driven by 150 HP, 1800 RPM, 3/60/440 volt, Class I, Group D, explosion proof, frame 445TS motor.

Spec. No. S-4355 Reqn. No. 21085 P. O. No. 106 ALG 536 F. No. 10308

CM-9F Recovery Vent Booster Compressor

Nash size AL-623 in bronze fitted construction complete with the following: John Crane type 8B2 code XP-1C1 single, outside, balanced, flushed, mechanical

seal; base plate suitable for 25 HP direct drive motor; Falk coupling; non-sparking coupling guard; and ASME (12" x 36") separator with Jerguson gauge glass. Compressor driven by 25 HP, 3500 RPM, 3/60/440 volt, Class 1, Group D, explosion proof, frame 284TS motor.

Spec. No. S-4723 Reqn. No. 21619 P.O. No. 106 ALG 946 F. No. 10308

CN-1F & CN-2F Recovery Condensers

Doyle and Roth VT-2461-20H horizontal shell and tube exchanger with fixed tube sheets consisting of a 24" O.D. carbon steel shell containing 502 - 3/4" O.D. x 18 BWG 304 stainless steel tubes 20 ft. long with 1976 sq. ft. heat transfer area. Design pressure 180 psig @ 380°F, both shell and tube side.
Tube pitch 15/16" triangular. Baffle spacing 15 inches.
Tubeside: 1 pass, nozzle sizes 8", 4", 2" - 150 lb. ASA;
Shellside: 1 pass, nozzle sizes 6", 6" - 150 lb. ASA.

Spec. No. 4428 Reqn. No. 21672 P.O. No. 106 ALG 992 F. No. 10485

CN-3F Vent Condenser for Monomer Recovery

Doyle and Roth VT-661-16H horizontal shell and tube exchanger with fixed tube sheets consisting of a 6.625" O.D. carbon steel shell containing 31 - 3/4" O.D. x 18 BWG 304 stainless steel tubes 16 ft. long with 98 sq. ft. heat transfer surface. Design pressure 180 psig @ 380°F, both shell and tube side.
Tube pitch 15/16" triangular. Baffle spacing 2¼".
Tubeside: 1 pass, nozzle sizes 2", 1½", 1½" - 150 lb. ASA
Shellside: 1 pass, nozzle sizes 2", 2" - 150 lb. ASA

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Spec. No. 4429 Reqn. No. 21661 P.O. No. 106 ALG-992 F. No. 10486

DE-1F Recovered Vinyl Water Decanter

24" O.D. x 6'6" straight side T304 stainless steel tank fabricated by Brighton Corporation according to ASME code part UW. Tank designed for 150 psig internal pressure @ 150°F. ASME flanged and dished heads are ¼" thick and the cylindrical shell is of 3/16" total thickness. All inside welds ground smooth and external welds wire brushed.

Spec. No. 4429 Reqn. No. 21661 P.O. No. 106 ALG 992 F. No. 10486

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FIL-1F to FIL-6F, FIL-9F, FIL-10F Recovery Filters

Cuno Model 14D2 filters 15-15/16" diameter x 39-13/16" overall length with 4" - 150 lb. ASA flanged inlet and outlet, welded steel ASME Code tank assembly for 150 psig design pressure. Each filter complete with 28 filter elements of viscose fibre, 25 micron density. Internal hardware is T316 stainless steel.

Spec. No. 4732 Reqn. No. 21697 P.O. No. 106 ALG 1035 F. No. 10379

FIL-7F & FIL-8F Recovery Filters

United States Filter Corporation single Maxi-Flo filters with ASME Code stamp. All construction of T304 stainless steel. Design units for 125 psig @ 200°F. Each unit complete with 4" - 150 lb. ASA inlet and outlet, pressure gauge, and 12 Auto-Spun elements with stainless steel core and 10 micron rating - each element 2½" diameter x 10"long.

Spec. No. 4732 Reqn. No. 21753 P.O. No. 106 ALG 1061 F. No. 10480

HE-1/TK-7F Heating Panel for 10,000 Gallon Surge Tank

Dean Products, Inc. P-23D type heating panel, 12" wide x 143" long, pattern 301, single embossed, rolled to an 8'0" diameter RW. Panel is constructed of 10 gage embossed on 12 gage companion. Panel is designed for 200 psi working pressure. Dean female coupling 1" inlet and 3/4" outlet surface mounted fittings for single pattern 301.

Spec. No. _____ Reqn. No. 21762 P.O. No. 106 ALG 1013 F. No. 10367

HE-1F Seal Water Cooler

Doyle and Roth LL 2068-16H horizontal shell and tube exchanger with fixed tube sheets consisting of 20" O.D. carbon steel shell containing 280 - 3/4" O.D. x 18 BWG admiralty tubes 16 feet long with 879 sq.ft. heat transfer surface. Design pressure - 180 psig @ 380°F for both shell and tube sides.

Tube pitch 15/16" triangular. Baffle spacing 10 inches.

Tubeside: 8 pass, nozzle sizes 3", 3" - 150 lb. ASA.

Shellside: 2 pass, nozzle sizes 3", 3" - 150 lb. ASA.

Spec. No. 4431 Reqn. No. 21585 P.O. No. 106 ALG 943 F. No. 10294

HE-2F Recovery Desuperheater

Doyle and Roth VT-1261-16H, horizontal shell and tube exchanger with fixed tube sheets consisting of a 12.75" O.D. carbon steel shell containing 126 - 3/4" O.D. x 18 BWG stainless steel tubes 16 feet long with 396 sq. ft. heat transfer surface. Design - 180 psig @ 380°F for shell and tube side.

Tube pitch 15/16" triangular. Baffle spacing 6 inches.

Tubeside: 1 pass, nozzle sizes 8", 8" - 150 lb. ASA.

Shellside: 1 pass, nozzle sizes 3", 3" - 150 lb. ASA.

Spec. No. 4761 Reqn. No. 21670 P.O. No. 106 ALG 992 F. No. 10484

PU-1F & PU-2F Recovered Vinyl Transfer Pump

Goulds Model 3196, size 1½ x 3 - 10, Group S, 1 stage centrifugal pump with wetted portions of 316 stainless steel construction. Complete with Crane type 9 QPICI mechanical seal, flange ratings - 150 lb. ASA. Shaft packing - Teflon. Pumps will deliver 20 GPM @ 111 ft. TDH during start-up or 130 GPM @ 56 ft. TDH when operating normally. At rating, BHP - 5.64, efficiency - 30%. Maximum BHP 6.4. Impeller diameter - 10". Minimum/maximum impeller - 6"/10". Rotation: right hand as viewed from coupling end. NPSH available - 6.5'. NPSH required - 2.8'. Pump driven by a 7½ HP, 1750 RPM, 3/60/440 volt, explosion-proof, frame 213T motor.

Spec. No. 4432 Reqn. No. 21491 P.O. No. 106 ALG 841 F. No. 10141

PU-3F & PU-7F Seal Water Pumps

Goulds Model 3196, size 1½ x 3 - 10, Group M, 1 stage centrifugal pump with wetted parts of cast iron construction with 316 stainless steel shaft sleeves. Complete with John Crane type 9 QPICI mechanical seal with glass filled Teflon lipseal, flange ratings - 150 lb. ASA. Shaft packing - Teflon. Pump will deliver 110 GPM @ 264 ft. TDH. At rating, BHP - 17.9, efficiency - 42%. Maximum BHP - 21. Impeller diameter - 8". Minimum/maximum impeller - 6"/10". Rotation: right

hand as viewed from coupling end. NPSH available - 26.3 feet. NPSH required - 3.7 feet. Pump driven by a 20 HP, 3500 RPM, 3/60/440 volt, explosion proof, frame 256T motor.

Spec. No. 4433 Reqn. No. 21579 P.O. No. 106 ALG 941 F. No. _____

PU-4F Seal Water Stripping Tank Pump

Goulds Model 3199, size 1 x 1 -5 Group T, 1 stage centrifugal pump with wetted parts of cast iron and bronze trim construction. Complete with John Crane type 9 QPICI mechanical seal with glass filled Teflon lipseal, flange ratings - 150 lb. ASA. Shaft packing - Teflon. Pump will deliver 35 GPM @ 44' TDH. At rating, BHP - 0.8. Efficiency - 48%. Maximum BHP - 0.85. Impeller diameter - 4". Minimum/maximum impeller - 3"/4-7/8". Rotation: right hand as viewed from coupling end. NPSH available - 10'. NPSH required - 8'. Pump driven by a 1 HP, 3500 RPM, 3/60/440 volt, explosion proof, frame 56T motor.

Spec. No. 4434 Reqn. No. 21575 P.O. No. 106 ALG 941 F. No. _____

PU-5F & PU-6F Chilled Water Pumps

Goulds Model 3196, size 4 x 6-13 Group M, 1 stage centrifugal pump with wetted parts of cast iron and 316 stainless steel shaft sleeve. Complete with John Crane type 9 QPICI mechanical seal, flange ratings - 150 lb. ASA. Shaft packing - Teflon. Pump will deliver 568 GPM @ 54.5' TDH. At rating, BHP - 9.75, efficiency - 80%, maximum BHP - 11. Impeller diameter - 13". Minimum/maximum impeller - 9"/13". Rotation: right hand as viewed from coupling end. NPSH available - 31.9'. NPSH required - 12.1'. Pump driven by 15 HP, 1150 RPM, 3/60/440 volt, explosion proof, frame 284T motor.

Spec. No. 4722 Reqn. No. 21608 P.O. No. 106 ALG 969 F. No. 10305

RF-1F Heavy Duty Industrial Refrigeration System

Frick heavy duty industrial refrigeration system in accordance with ASME Codes and suitable for Class 1, Group D explosion proof area.

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The refrigeration system contains the following equipment: 3 - heavy duty 7" x 7" two cylinder enclosed ammonia compressors arranged for V-belt drive at 440 RPM with suction pressure switches to start and stop compressors according to load, automatic starting by-pass, V-belts, belt guards, and base plate for mounting 75 HP, 1800 RPM, 3/60/440 volt, Class I, Group D, frame size 365T motor. Capacities at 215 psig condensing pressure in accordance with Frick data sheets as follows:

No. Comp.	Evap. Temp. & Press.	Capy. Tons Ref. ea.	Capy. Tons Ref. total
1	50°F (75 psig)	81	81
2	28°F (42.6 psig)	50.5	101
3	11°F (24.7 psig)	33.3	100
3	0°F (15.7 psig)	26.3	79

Each compressor has an oil pressure failure switch, a cylinder jacket temperature switch, a low suction pressure switch, a high discharge pressure switch, a #160-0S8 scrubber type automatic oil separator for automatically returning oil from the discharge line to the compressor crankcase, a separator pressure relief valve, and a 1½" check valve to prevent any blow back when shut down. Compressor jacket has a water solenoid valve to shut the water off when the compressor motor is not operating.

One ammonia condenser 120MS2018, 20" O.D. carbon steel shell with 120 - 1¼" O.D. x 13 BWG carbon steel tubes 18' long with 708 sq. ft. effective surface operating at 105°F condensing temperature @ 214.2 psig when supplied with 320 GPM of 85°F cooling water. Condenser is equipped with necessary ammonia valves and fittings, safety relief valves, supports and a 4" - 6V pilot operated water regulating valve type PX # 11167.

Design: Tubeside - 100 psig, shellside - 250 psig.

One ammonia liquid receiver 20" x 14" long with all needed ammonia valves, fittings, gage glass, etc. Design 250 psig.

One Ice reserve unit Model 240-IR-50 with 50,000 lbs. nominal ice capacity, and 4,330 lineal ft. of 1¼" sched. 40 CS pipe arranged with 14 pipe coils wide 16 pipes high 19'-4" long on 8" centers complete with tank and covers, necessary ammonia piping and controls including: expl. proof solenoid valve, flanged liquid and suction connections. accumulator, float assembly oil drain piping etc. and complete with necessary water controls inlet and outlet pipe connections, water level float valve, overflow and drain, remote ice limit thermostat, baffles, coil supports, dynamically balanced agitators, screens, V-belts, pulleys, mounts for 2 HP, 1800 RPM 440/60/3 Class I, Group D motors. Agitators will provide a velocity past the coils adequate for burn-off rates of 5-6 tons/1000 lbs. of ice. Inside tank dimensions 23'4" long x 9'5" wide x 9'0" high.

One 30" x 72" Instrument Panel with two 4½" pressure gages to indicate the suction and discharge pressure. Suction and discharge pressure switches and necessary relays for the system all factory mounted. Protective devices included will be for 110 volts, single phase, 60 cycle and for Class 1, Group D locations.
Spec. No. 4509 Reqn. No. 21540 P.O. No. 66 ALG 337 F. No. 10363

SE-1F to SE-3F 500 Gallon Recovery Separators

500 gallon type 304 stainless steel tanks, 3'6" O.D. x 6'3" straight sides 5/8" thick shell and 5/8" thick ASME F & D heads fabricated by Alloy Crafts Co. Design pressure 255 psig & full vacuum @ 150°F. Vapor entry tangential near top of straight side. Tanks are provided with agitators for reslurrying entrained material before dropping to blend tanks.

Spec. No. S-4128 Reqn. No. 21240 P.O. No. 106 ALG 782 F. No. 10287

SE-5F High Efficiency Entrainment Separator

One V.D. Anderson Company's Type LS-6-180 Hi-ef special with top inlet and side outlet, 14" O.D. x 48" straight side of carbon steel construction. Spray nozzle and removable element constructed of type 304 stainless steel. Tank designed for 180 psig @ 400°F.

Top head openings: 1 - 4" - 150 lb. ASA nozzle for gas inlet.

Shell openings: 1 - 4" - 150 lb. ASA nozzle for liquid level control. 1 - 4" - 150 lb. ASA nozzle with a ½" - 3000 lb. I.P.S. threaded coupling for removable spray nozzle assembly. 1 - 6" - 150 lb. ASA flange for gas outlet. 2 - 3/4" 3000 lb. I.P.S. couplings for gage glass.

Bottom head openings: 1 - 2" - 150 lb. ASA flange for liquid drain.

Tank flanged across girth for cleaning if necessary.

Spec. No. 4414 Reqn. No. 21637 P.O. No. 96 ALG 1544 F. No. 10364

SE-6F 500 Gallon Recovery Separator

One vertical carbon steel tank 3'6" O.D. x 6'3" straight side fabricated by Youngstown Steel Tank Company. Design for 255 psig and full vacuum @ 150°F. ASME F & D heads are 11/16" thick, cylindrical shell is ½" thick.

Top head openings: 1 - 2", 2 - 1½", 1 - 4" - 150 lb. ASA flanged nozzles.

Shell openings: 1 - 8", 4 - 4", 1 - 18" manway with hinged & bolted cover, and 3 - ½" - 3000 lb. couplings. Flanges are 150 lb. ASA.

Bottom openings: 1- 3" - 150 lb. ASA flanged nozzle.

Spec. No. E-4128 Reqn. No. 21531 P.O. No. 66 ALG 359 F. No. _____

TK-1F& 2F Recovered Vinyl Chloride Receivers

Vertical 5010 gallon Vinyl Chloride receivers 8'0 " O.D. x 12'0" straight side made of 15% 304 stainless steel clad on A-212 grade B carbon steel backing fabricated by Superior Welding Co. ASME Code flanged and dished heads to be 3/4" total thickness and the shell to be 9/16" total thickness. Tanks are rated for 150 psig and full vacuum @ 150°F. These tanks are located outside the process building and are insulated and mounted on heated skirts to keep any water in the bottom of the tanks from freezing.

Spec. No. E-4131 Reqn. No. 21245 P.O. No. 66 ALG 252 F. No. 10145

TK-3F 150 Gallon Seal Water Stripping Tank

One vertical 150 gallon carbon steel tank 30" O.D. x 3'8" straight side fabricated by Industrial Metal Products Co. Design: 50 psig & full vacuum @ 450°F.

Spec. No. 4416 Reqn. No. 21260 P.O. No. 106 ALG 754 F. No. 10132

TK-6F 300 Gallon Seal Water Tank

One vertical carbon steel tank 36" O.D. x 4'2" straight side fabricated by Youngstown Steel Tank Company. Design: 50 psig and full vacuum @ 450°F.

Spec. No. 4415 Reqn. No. 21260 P.O. No. 106ALG 754 F. No. 10131

TK-7F Vinyl Chloride Surge Tank

10,000 gallon, horizontal, carbon steel surge tank, 8'0" O.D. x 24'0" straight sides fabricated by Kennedy Tank & Mfg. Co. Shell thickness 3/4" - elliptically dished heads 5/8" thick. Design pressure 200 psig and F.V. at 300°F. Vessel interior coated with plastic #7122 epoxy phenolic coating to minimum dry thickness of 5 mils. Tank located outside process building and is insulated.

Spec. No. 4435 Reqn. No. 21558 P.O. No. 106 ALG 936 F. No. 10384

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EQUIPMENT LIST

BL-1G Primary Fan for 1st Stage Venturi Unit

Clarage #3060 Type AF airfoil fan, SW-SI, Arr. 9 complete with flanged inlet and outlet, V-belt drive with B.F.Goodrich belts and belt guard. Orientation and rotation: CW-THD.

To be capable of supplying 15,000 cfm of 70°F air at 7" W.G. static pressure when driven by a 25 HP, 1800 RPM, Class I, Group D, explosion-proof, 220/440 volt, 60 cycle, 3 phase motor with a 284 T frame. At capacity, BHP 20.2 and blower RPM-1501.

Spec.No. 4392 Reqn.No. 20965 P.O.No. 106 ALG-488 F.No. 10122

BL-2G 2nd Stage Venturi Exhaust Blower

Buffalo Forge 45 MW fan in arrangement #9, CCW-UBD and type 304 stainless steel construction. Fan complete with flanged inlet and outlet connections, V-belt drive with B.F.Goodrich belts and belt guard. Fan to delivery 7000 cfm of 160°F air at 6" W.G. static pressure, 1230 RPM and 10.8 BHP using a 15 HP, 1800 RPM, 3/60/440 volt, explosion-proof, frame 254T motor.

Spec.No. 4392 Reqn.No. 20964 P.O.No. 106 ALG-495 F.No. _____

BL-3G Main Fan for Venturi Dryer System

Buffalo Forge 805-L-25 heavy duty fan in arrangement #8, CCW-UBD, in Class "C" spark-proof construction. Fan complete with split housing, flanged inlet and outlet connections, manually operated inlet vanes, plate type flush mounted clean-out door, coupling and coupling guard. Fan to deliver 25000 cfm of 150°F air at 21" W.G. static pressure, 1780 RPM and 98 BHP when driven by a 100 HP, 1800 RPM, 3/60/440 volt, TEFC, frame 405TS motor.

Spec.No. 4392 Reqn.No. 20964 P.O.No. 106 ALG-495 F.No. 10076

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BL-4G Cold Powder Conveying System Exhaust Blower

Buffalo Forge 30MW fan in modified arrangement #9, CW-THD of type 304 stainless steel construction. Fan complete with flanged inlet and outlet connections, V-belt drive using B.F.Goodrich belts and belt guard. Fan to delivery 3800 CFM of 100°F air at 18" W.G. static pressure, 2880 RPM and 16.8 BHP using a 20 hp, 3600 rpm, Class I, Group D, explosion-proof, frame 256T motor.

Spec.No. 4392 Reqn.No. 20964 P.O.No. 106 ALG-495 F.No. 10088

BL-5G & BL-6G Storage Bin Exhaust Fans

Clarage No. 113 Type XL Fans, arrangement #9, SW-SI, complete with open type wheel, flanged inlet and outlet, V-belt drive with B.F.Goodrich belts, and belt guard. Each has capacity to exhaust 4000 scfm of air with 6" W.G. static pressure at 1660 RPM and 7.32 BHP. Driven by a 10 HP, 1800 RPM, 440-volt, 60 cycle, 3 phase, explosion-proof, Class I, Group D, motor with a 215T frame.

Spec.No. 4392 Reqn.No. 20965 P.O.No. 106 ALG-488 F.No. 10123

CE-1G Venturi Dryer Centrifuge

Bird Machine Company 32" x 50" continuous solid bowl centrifuge; complete with SA-70, 40:1 gear ratio, and constructed of 304 stainless steel throughout where in contact with PVC. Also complete with 270°F solids discharge gutter, wash pipe and nozzles for internal rinsing, Korfund vibration isolaters, B.F.Goodrich belts and sheaves for 1400 rpm operation. Bowl is a cylinder and 10° cone configuration. Equipped with feed tube and case seals to reduce internal windage. To process 8000 lbs./hr. PVC (dry basis) giving a wet cake of approximately 75% total solids. Bowl equipped with longitudinal strips; bowl polished between strips. Driven by a 75 hp, 1800 rpm, 440 volt, 60 cycle, 3 phase, TEFC, explosion-proof motor with frame 444U.

Spec.No. _____ Reqn.No. 20706 P.O.No. 66 ALG-95 F.No. 8841

Spec.No. G-10699 Reqn.No. 21417 P.O.No. 106 ALG-910 F.No.

CV-3G & CV-4G Second Stage Cyclone Product Conveyors

A screw type conveyor driven by a 3/4 HP, 45 RPM, 3/60/440 volt, frame 56-5, type JV-GD totally enclosed mounting position C-1 motor. All parts in contact with PVC of stainless steel. Flange ball bearings for 2" shaft. Length of CV-3G as measured between centerlines of inlet and outlets is 2'0". All other dimensions per B.F.Goodrich DWGS. G-9312 & G-9275. Product outlet to have hinged door.

Conveyor CV-4G is identical to above except length between center lines of inlet and outlet is 3'0" and outlet flange is 12" square instead of 12" I.D.

Spec.No. G-9312 Reqn.No. 21417 P.O.No. 106 ALG-910 F.No.

CV-5G Product Conveyor to Silos

CV-5G duplicates CV-3G.

Spec.No. G-9312 Reqn.No. 21417 P.O.No. 106 ALG-910 F.No.

DR-1G First Stage Venturi Dryer Section

Constructed of 16 gauge stainless steel. Throat section -- 20" I.D. and 13' length. Feed point approximately 4' above plenum. See BFG. Dwg. E-4134 for details and dimensions. Throats expands to 54" I.D. section in a length of 15'. 54" I.D. drying section -- 15'3" long. 54" I.D. reduces down to a 40" I.D. in a length of 6'9" I.D. section approximately 55' in length to entrance of 1st stage product cyclone.

Spec.No. E-4134 Reqn.No. P.O.No. F.No.

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DR-2G Second Stage Venturi Dryer Section

Composed of 14" I.D. and 18" I.D. sections. 18" I.D. section approximately 22' long. Reduces down to 14" I.D. section at point just upstream from 1st stage cyclone product outlet. 18" I.D. section of 16 ga. stainless steel and 14" I.D. section of 16 ga. stainless steel. Length of section between cyclone product

outlet and 2nd stage cyclone entrance -- approximately 52'.

Spec.No._____ Reqn.No._____ P.O.No._____ F.No._____

FIL-1G & FIL-2G Venturi 1st and 2nd Stage Air Filters

Farr Company size 4-104 Model V7-B2 Far-Air-Hi-Kleen Filter in two stages - a manually operated roll unit with Fibre glass media for the first stage followed by HP-2A second stage filters - to handle 15,000 SCFM air with a pressure drop of 0.26"W.G.

FIL-2G is identical to FIL-1G except for the following:

1. Filter to handle 6000 SCFM air with a pressure drop of 0.23" W.G.
2. Filter is Farr Company Model V7-B2 size 3-64 Far-Air-Hi-Kleen Filter.

Spec.No. 4380 Reqn.No. 20942 P.O.No. 106 ALG-430 F.No. 9919

FIL-4G Air Filters for Cold Powder Conveying Line

Farr Company 24 x 24 x 8 HP-2A filters complete with sealer frame, retainer, holding frame, filter cartridge, and fasteners.

Spec.No._____ Reqn.No. 20942 P.O.No. 106 ALG-430 F.No. 9971

HE-1G Venturi 1st Stage Heating Unit

Two #E-54 L.J.Wing Integral Face & bypass heating coils. Units to be stacked 2 high and have the capacity to heat 15,000 SCFM of air from -10° to 95°F using 30 psig steam. Units complete with integral face and bypass dampers including pneumatic damper motors and a common air stream thermostat. Pressure drop 0.1"W.G.

Spec.No. 4379 Reqn.No. 21052 P.O.No. 106-ALG-558 F.No. 10065

HE-2G Venturi 2nd Stage Heating Unit

Consists of four (4) American Standard size H-2V4-23-84 heavy duty coils with tube couplings. Tubes - 90/10 CuNi alloy, 0.049" wall thickness, solder coated fins. Air tight steel casings. 23 tubes in face; tube length - 84". Each coil is 37 5/16" high and 92½" wide. 100½" space needed for coil removal. Duty - to

heat 15,000 SCFM of air from 100°F to 350°F using 180 psig saturated steam.

Spec.No._____ Reqn.No. 21289 P.O.No. 106-ALG-743 F.No. 9994

HE-3G Slurry Sparge Heater

180 psig saturated steam will sparge directly into slurry. Designed to heat 26,600 lbs/hr. 30% total solids PVC slurry from 100°F to 170°F. Duty -- 1,599,000 Btu/hr. or 1510 lb./hr. steam. All parts in contact with PVC of 304 stainless steel. Fabricated by G.H. Hicks and Sons. Steam sparges from a $1\frac{1}{2}$" diameter pipe into a concentric 3" schedule 5 pipe containing the slurry sparger having 4 rows of holes with 33 holes in each row at $\frac{1}{2}$" hole spacings. Rows are 90° apart vertically and horizontally. All flanges 150# ASA.

Spec.No. 4382 Reqn.No. 21143 P.O.No. 106-ALG-668 F.No. 10077

HE-4G Second Stage Air Heater

Consists of two (2) American Standard size H-2V4-20-48M heavy duty coils with tube couplings. Tubes of 90/10 CuNi alloy, 0.049" wall thickness, solder coated fins. Air tight steel casing. 20 tubes in face. Each coil is 33-3/16" high and 56-$\frac{1}{2}$" wide. Tube length 48". 64" space needed for coil removal. Has capacity to heat 6000 scfm of air from 0°F to 250°F using 30 psig saturated steam in 1st coil and 180 psig saturated steam in 2nd coil.

Spec.No. 4379 Reqn.No. 21289 P.O.No. 106-ALG-743 F.No. 9995

HE-5G Storage Bin Fluidizing System Heater-Cooler Unit

American-Standard unit consisting of a size H-2M-11-24 coil for heating and a modified HW-2M-11-24MM $\frac{1}{2}$ circuited coil for cooling. Heating coil - 11 tubes in face, 24" length, 20-5/8" coil height, and $32\frac{1}{2}$" coil width. Duty - to heat 1600 scfm of air from 70°F to 180°F using 180 psig saturated steam. Cooling section identical to heating section except that it is $\frac{1}{2}$ circuited. Duty - to cool 1600 scfm of air from 180°F to 142°F when supplied with 25 GPM of 85°F water. Pressure drop of water through unit - 9.3' H_2O. Total pressure drop of air across unit 0.265" W.G. All tubes of 90/10 CuNi alloy, 0.049" wall thickness, and solder

coated fins.

Spec.No. 4397 Reqn.No. 21058 P.O.No. 106-ALG-559 F.No. 10093

Magnet - 1G & Magnet-2G Dryer Magnets

Two Magni-Power Company double bank drawer grids, 11-3/4" long x 12-1/2" wide with six (6) 7/8" diameter x 12" long grid tubes on top row and five (5) 7/8" diameter x 12" long grids on bottom row. Units complete with housing and top and bottom mounting flanges per BFG Specification 5-4514, Page 2 of 2. All parts in contact with powder to be type 304 SS construction.

Spec.No. 4514 Reqn.No. 21317 P.O.No. 96-ALG-1329 F.No. 10176

PL-1G Venturi Dryer Feed Pulverizer

A squirrel cage type device consisting of 1/8" SS welding rods parallel spaced in a circle at 1" spacings inserted and welded into three 10 ga. 14" diameter SS plates; one plate on each end and one in the middle to form pulverizer cage. Driven by a 1/2 HP., 37 rpm, 440 v[illegible] cycle, 3 phase, Class I, Group D, U.S. Synchro-gear motor using Frame 56-7-6 Type EV-GW mounting position F-2. 1" motor shaft connected to 3/4" pulverizer shaft by a Lovejoy L-095 flexible coupling. Pulverizer shaft bearing - Sealmaster NP-12. B.F.Goodrich Dwg. G-10741.

Spec.No. G-10741 Reqn.No. 21247 P.O.No. 106-ALG-734 F.No. 10067

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SCR-1G & SCR-2G PVC Resin Screeners

Rotex Model #42 Type A-AL/SS Screeners with capacity to handle 8000 lbs/hr. PVC powder through two 42 mesh screen in series. Particle size range of powder to screener 30-180 microns with traces of coarser material. Aluminum top cover, screen frame and spacer frame, SS bottom pan and box frame lining. V-belt drive using B.F.Goodrich belts and belt guards. Bottom pan arranged so that oversized material from both frames will discharge through common outlet. Both outlets 6" diameter. #351 Nitex Bolting Cloth with Bond Tite and aluminum grommets and overall dimensions of 39" x 83" and 39" x 92". Motor - 2 HP., 1800 rpm, 440 volt, 60 cycle, 3 phase, Class I, Group D, explosion-proof motor with 184 frame. Overall length -

125 3/4". Overall height - 46-3/8".

Spec.No. 4381 Reqn.No. 20915 P.O.No. 106-ALG-395 F.No. 9972

SE-1G Slurry Feed Magnetic Separator

Eriez 2" pipeline model B-2 Ferrotrap with standard pipe thread connections. Overall length - 11". Trap nominal diameter - 5". Magnetic element consists of five magnetic fingers of 316 SS construction.

Spec.No. _____ Reqn.No. 20850 P.O.No. 96-ALG-659 F.No. 9973

SE-2G Venturi Dryer 1st Stage Product Separator

Ducon size 450 type SDM Duclone, complete with outlet scroll, access door in cone, and dust trap to accommodate 500# PVC resin. Reinforced for (-20") W.G. pressure operation. Metal in contact with resin of 304 SS; 11 ga. Capacity 17,600 cfm of 160°F air containing 135 lbs. per min. PVC and 4.5 lbs. per min. water vapor. Powder 30 to 180 microns with 90% larger than .50 microns sp. gr. 1.3 to 1.4 Operating pressure drop across unit - 5.2" W.G.

Spec.No. 4375 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9986

SE-3G Venturi Dryer 2nd Stage Product Collector

Ducon size 190 type SDM Duclone duplicates SE-2G except for design rate and size. Design rate - 7000 cfm of 160°F containing 135 lbs. per min. PVC resin and 2 lbs. per min. water vapor. Pressure drop at operating conditions - 4.6" W.G.

Spec.No. 4375 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9987

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SE-4G Venturi Dryer 1st and 2nd Stage Dust Collector

Aerotec tubular dust collector, model 6UPV #7-105, with vertical bottom inlet and outlet. Construction - stainless steel. Air inlet and outlet and powder outlet flanged. Access panels for all compartments, pipe nozzles and caps above each row of tubes for air lancing. Tube sheet vertical rather than horizontal. Tubes sloping at an angle towards powder discharge. Operating pressure -20"W.G. negative pressure and maximum pressure drop of 8"W.G.

Precipitating tubes - 6-5/8" outside diameter standard tubing with 0.134" wall,

all welded construction. Each tube equipped with eight inlet openings and directional guides at inlet to said openings and welded top and bottom to tube sheet. The sheet and outlet envelope - 1/8" steel plate. Hopper cone - 54 ft.^{3}. To handle 25,000 cfm of 160°F air containing 1.5 lbs/min. PVC dust in particle size range of 30 to 180 microns and sp.gr. of 1.3 to 1.4. Separating efficiency of 30 micron material 99.0% at 4" W.G. pressure drop.

Spec.No. 4374 Reqn.No. 21103 P.O.No. 106 ALG-617 F.No. 10063

SE-5G & SE-6G Storage Bin Dust Collectors

Carter Day Company #24RJ48 Day Filters without hoppers. Fabricated of 12 g. mild steel with all parts in contact with PVC epoxy coated. Complete with 2' high body extension fitted with interlaced ½" dia. SS rods spaced on 13" centers and welded to body. ½" HP, V.L.W.F. 118 Boston reduction with 1800 rpm, 220/440 volts, 60 cycle, 3 phase, Class I, Group D, Frame 56C motor. Dacron filter sleeves. Filter body flanged for direct connection to storage bin. 3A-6 pressure blower with 2 HP, 3600 RPM, 220/440 volt, 60 cycle, 3 phase, Class I, Group D, motor with frame no. 184.

Spec.No. 4398 Reqn.No. 20891 P.O.No. 106 ALG-376 F.No. 9091

SE-7G Cold Powder Conveying Cyclone

Ducon size 100 type SDM Duclone, complete with outlet scroll, access door in cone, and dust trap. Reinforced for (-20) W.G. pressure operation. Metal in contact with resin of type 304 stainless steel; 11 gage. capacity 4000 cfm of 120°F air containing 135 lbs/min. PVC powder of 50 to 180 micron particle size. Operating pressure drop access unit -6" W.G.

Spec.No. 4376 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9988

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TK-1G & 2G Product Storage Bins

Fabricated by Graver Tank and Manufacturing Co., per B.F.Goodrich Dwgs. E-4130 and G-10723. Bin diameter 16'0" x 20'0" high erected on 16'0" diameter x 3'6" high base. Internal welds ground smooth for epoxy coating. All grating, Kerrigan 1" x 3/16" Type K-300. Base constructed with 8" C.S. pipe for fluidizing unit connections. All carbon steel surfaces exposed to PVC are epoxy coated. Grating bearing bars and bolts exposed to PVC of SS construction. That not exposed to PVC of C.S. construction. $\frac{1}{4}$" base wall thickness. Each tank has two 8" nozzles with 150 lb. ASA pipe flange drilling and made of SCH 5 stainless steel. Three, each, 3/4" full pipe couplings for sampling and temperature indicator. Manway with hinged cover on top and side both. Capacity 120,000# PVC. Bin walls constructed of carbon steel with epoxy coating.

Spec.No. G-10723 Reqn.No. 21149 P.O.No. 66 ALG-228 F.No. 10129

EQUIPMENT LIST

BL-1H & BL-2H Primary Fan for 1st Stage Venturi Unit

American-Standard size 21 AH industrial fan in Arr. 9 complete with flanged inlet and outlet, outlet dampers, V-belt drive with B.F.Goodrich belts and belt guard. Orientation and rotation: CW-THD.

To be capable of supplying 9500 cfm of 70°F air at 7" W.G. static pressure when driven by a 20 HP, 1800 RPM, Class 1, Group D, explosion-proof, 220/440 volt, 60 cycle, 3 phase motor with a 256T frame. At capacity, BHP 15.5 and blower RPM-1100.

Spec.No. 4392 Reqn.No. 20963 P.O.No. 106 ALG-487 F.No. 9989

DL-3H & BL-4H 2nd Stage Venturi Exhaust Blower

Buffalo Forge 35 MW fan in arrangement #9, CCW-UBD and type 304 stainless steel construction. Fan complete with flanged inlet and outlet connections, V-belt drive with B.F.Goodrich belts and belt guard. Fan to deliver 4450 cfm of 160°F air at 6" W.G. static pressure, 1600 RPM and 7.0 BHP using a 10 HP, 1800 RPM, 3/60/440 volt, explosion-proof, frame 215T motor.

Spec.No. 4392 Reqn.No. 20964 P.O.No. 106 ALG-495 F.No. _____

BL-5H & BL-6H Main Fan for Venturi Dryer System

Buffalo Forge 805-L-21 heavy duty fan in arrangement #8, CCW-UBD, in Class "C" spark-proof construction. Fan complete with split housing, flanged inlet and outlet connections, manually operated inlet vanes, plate type flush mounted clean-out door, coupling and coupling guard. Fan to deliver 16000 cfm of 160°F air at 21" W.G. static pressure, 1780 RPM and 63.25 BHP when driven by a 75 HP, 1800 RPM, 3/60/440 volt, TEFC, frame 365TS motor.

Spec.No. 4392 Reqn.No. 20964 P.O.No. 106 ALG-495 F.No. 10075

BL-7H & BL-8H Cold Powder Conveying System Exhaust Blower

American-Standard size 110MH industrial fan in arrangement #1, CW-TID and of type 304 stainless steel construction. Fan complete with flanged inlet and outlet connections, V-belt drive using B.F.Goodrich belts and belt guard. Fan to deliver 2400 cfm of 100°F air at 18" W.G. static pressure, 3450 RPM and 11.3 BHP using a 15 hp, 3600 rpm, Class I, Group D, explosion-proof, frame 254T motor.

Spec.No. 4392 Reqn.No. 20963 P.O.No. 106 ALG-487 F.No. 9990

BL-9H to BL-12H Storage Bin Exhaust Fans

Clarage No. 113 Type XL Fans, arrangement #9, SW-SI, complete with open type wheel, flanged inlet and outlet, V-belt drive with B.F.Goodrich belts, and belt guard. Each has capacity to exhaust 4000 scfm of air with 6" W.G. static pressure at 1660 RPM and 7.32 BHP. Driven by a 10 HP, 1800 RPM, 440 volt, 60 cycle, 3 phase, explosion-proof, Class 1, Group D, motor with a 215T frame.

Spec.No. 4392 Reqn.No. 20965 P.O.No. 106 ALG-488 F.No. 10123

CE-1H & CE-2H Venturi Dryer Centrifuge

Bird Machine Company 24" x 38" continuous solid bowl centrifuge; complete with SA-70, 40:1 gear ratio, and constructed of 304 stainless steel throughout where in contact with PVC. Also complete with 270°F solids discharge gutter, wash pipe and nozzles for internal rinsing, Korfund vibration isolaters, B.F.Goodrich belts and sheaves for 2000 rpm operation. Bowl is a cylinder and 10° cone configuration. Equipped with feed tube and case seals to reduce internal windage. To process 5000 lbs./hr. PVC (dry basis) giving a wet cake of approximately 75% total solids. Bowl equipped with longitudinal strips; bowl polished between strips. Driven by a 40 hp, 1800 rpm, 440 volt, 60 cycle, 3 phase, explosion-proof motor with frame 364U.

Spec.No. _____ Reqn.No. 20706 P.O.No. 66 ALG-95 F.No. 9897

CM-1H & CM-2H Venturi Dryer Storage Bin Fluidizing Compressor

Roots Connersville, size 820 type RAS rotary, positive displacement air compressor. Complete with double sealing arrangement and flexible coupling, coupling guard, base under compressor and driver, inlet filter-silencer, discharge silencer, safety relief valve, discharge expansion joint, high air temperature switch, and low oil pressure switch. To handle 1600 cfm of air at suction conditions (standard conditions) and a 5.5 psig discharge pressure. Driven by a 60 HP, 1200 RPM, 440 volt, 60 cycle, 3 phase, TEFC, motor with a 404TS frame. BHP at compressor coupling --- 49.5. Compressor RPM --- 1160.

Spec.No. 4396 Reqn.No. 21057 P.O.No. 106 ALG-545 F.No. 10089

CV-1H & CV-2H Wet Cake Feed Conveyor

Syntron Model FH-33-A (unsealed) Electric Vibrating Feeder equipped with the following: 11½" wide by 77-3/4" long by 1/4" thick non-radiused trough, 12¼" deep at intake and 7-3/4" deep at discharge end, incorporating a 8" radius concave discharge lip. All surfaces in contact with PVC of 304 stainless steel. Trough discharge end incorporates a mild steel flange as shown on B.F.Goodrich Chemical Company Dwg. G-10743 and includes an elongated hole on each side of the trough located approximately 26" from discharge end and 5½" above trough bottom. Feeder equipped with below deck driving magnet and suspension mounted with feeder trough elevated 15° in direction of material discharge. Complete with a Model C-4 Syntron Electric Silicon Rectifier Type Dust-Tight Controller. Equipment arranged for 440 volt, 60 cycle, single phase operation.

Spec.No. G-10743 Reqn.No. 21248 P.O.No. 106 ALG-740 F.No. 10139

CV-3H & CV-4H First Stage Cyclone Product Conveyor

A screw type conveyor driven by a 3/4 hp, 440 volt, 60 cycle, 3 phase, U.S. Syncrogear, frame 56-5, type JV-GD totally enclosed mounting position C-1 motor. All parts in contact with PVC of stainless steel. Flange ball bearings for 2" shaft. Length of conveyor as measured between center lines of inlet and outlet

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is 3'0". All other dimensions per B.F.Goodrich Chemical Co. Dwgs. G-10699 and 10700. Product outlet to have hinged door. Shaft speed 45 RPM.

Spec.No. G-9312 Reqn.No. 21417 P.O.No. 106 ALG-910 F.No. 10374

CV-5H to CV-8H Second Stage Cyclone Product Conveyors

A screw type conveyor driven by a 3/4 hp, 45 rpm, 3/60/440 volt, frame 56-5, type JV-GD totally enclosed mounting position C-1 motor. All parts in contact with PVC of stainless steel. Flange ball bearings for 2" shaft. Length of CV-5H & CV-6H as measured between centerlines of inlet and outlets is 2'0". All other dimensions per B.F.Goodrich Dwgs. G-9312 & G-9275. Product outlet to have hinged door. Conveyors CV-7H & CV-8H are identical to above except length between centerlines of inlet and outlet is 3'0" and outlet flange is 12" square instead of 12" I.D.

Spec.No. G-9312 Reqn.No. 21417 P.O.No. 106 ALG-910 F.No. 10374

DR-1H & DR-2H First Stage Venturi Dryer Section

Constructed of 16 gauge stainless steel. Throat section -- 16" I.D. and 8' length. Feed point approximately 4' above plenum. Throat expands to 42" I.D. section in a length of 15'. 42" I.D. drying section -- 18'9" long. 42" I.D. reduces down to a 30" I.D. in a length of 6'9" I.D. section approximately 55' in length to entrance of 1st stage product cyclone.

Spec.No. E-4134 Reqn.No._____ P.O.No._____ F.No._____

DR-3H & DR-4H Second Stage Venturi Dryer Section

Composed of 14" I.D. and 12" I.D. sections. 14" I.D. section approximately 22' long. Reduces down to 12" I.D. section at point just upstream from 1st stage cyclone product outlet. 14" I.D. section of 16 ga. stainless steel and 12" I.D. section of 16 ga. stainless steel. Length of section between cyclone product outlet and 2nd stage cyclone entrance -- approximately 46'.

Spec.No._____ Reqn.No._____ P.O.No._____ F.No._____

FIL-1H to FIL-4H Venturi 1st and 2nd Stage Air Filters

Farr Company size 3-84 Model V7-B2 Far-Air-Hi-Kleen Filter in two stages - a manually operated roll unit with Fibre glass media for the first stage followed by HP-2A second stage filters - to handle 9300 SCFM air with a pressure drop of 0.30" W.G.

FIL-3H & FIL-4H are identical to FIL-1H & FIL-2H except for the following:

1. Filter to handle 3800 SCFM air with a pressure drop of 0.10" W.G.
2. Filter is Farr Company Model V7-B2 size 3-64 Far-Air-Hi-Kleen Filter.

Spec.No. 4380 Reqn.No. 20942 P.O.No. 106 ALG-430 F.No. 9919

FIL-7H & FIL-8H Air Filters for Cold Powder Conveying Line

Farr Company 24 x 24 x 8 HP-2A filters complete with sealer frame, retainer, holding frame, filter cartridge, and fasteners.

Spec.No. 4380 Reqn.No. 20942 P.O.No. 106 ALG-430 F.No. 9971

HE-1H & HE-2H Venturi 1st Stage Heating Unit

Two #E-60 L.J. Wing Integral Face & bypass heating coils. Units to be stacked 2 high and have the capacity to heat 9300 SCFM of air from -10° to 100°F using 30 psig steam. Units complete with integral face and bypass dampers including pneumatic damper motors and a common air stream thermostat. Pressure drop 0.13"W.G.

Spec.No. 4378 Reqn.No. 21052 P.O.No. 106-ALG-558 F.No. _____

HE-3H & HE-4H Venturi 2nd Stage Heating Unit

Consists of three (3) American Standard size H-2V4-23-84 heavy duty coils with tube couplings. Tubes - 90/10 CuNi alloy, 0.049" wall thickness, solder coated fins. Air tight steel casings. 23 tubes in face; tube length - 84". Each coil is 37-5/16" high and 92-1/2" wide. 100-1/2" space needed for coil removal. Duty - to heat 9300 SCFM of air from 100°F to 350°F using 180 psig saturated steam.

Spec.No. 4378 Reqn.No. 21289 P.O.No. 106-ALG-743 F.No. 10058

HE-5H & HE-6H Slurry Sparge Heater

180 psig saturated steam will sparge directly into slurry. Designed to heat 16,700 lbs/hr. 30% total solids PVC slurry from 100°F to 170°F. Duty -- 1,069,000 Btu/hr. or 1010 lb./hr. steam. All parts in contact with PVC of 304 stainless steel. Fabricated by G.H. Hicks and Sons. Steam sparges from a 1-1/2" diameter pipe into a concentric 3" schedule 5 pipe containing the slurry sparger having 4 rows of holes with 33 holes in each row at 1/2" hole spacings. Rows are 90° apart vertically and horizontally. All flanges 150# ASA.

Spec.No. 4383 Reqn.No. 21143 P.O.No. 106-ALG-668 F.No. 10077

HE-7H & HE-8H Second Stage Air Heater

Consists of two (2) American Standard size H-2V4-14-48M heavy duty coils with tube couplings. Tubes of 90/10 CuNi alloy, 0.049" wall thickness, solder coated fins. Air tight steel casing. 14 tubes in face. Each coil is 24-13/16" high and 56-1/2" wide. Tube length 48". 64" space needed for coil removal. Has capacity to heat 3800 scfm of air from 0°F to 250°F using 30 psig saturated steam in 1st coil and 180 psig saturated steam in 2nd coil.

Spec.No. 4378 Reqn.No. 21289 P.O.No. 106-ALG-743 F.No. 10059

HE-9H & HE-10H Storage Bin Fluidizing System Heater-Cooler Unit

American-Standard unit consisting of a size H-2M-11-24 coil for heating and a modified HW-2M-11-24MM 1/2 circuited coil for cooling. Heating coil - 11 tubes in face, 24" length, 20-5/8" coil height, and 32-1/2" coil width. Duty - to heat 1600 scfm of air from 70°F to 180°F using 180 psig saturated steam. Cooling section identical to heating section except that it is 1/2 circuited. Duty - to cool 1600 scfm of air from 180°F to 142°F when supplied with 25 GPM of 85°F water. Pressure drop of water through unit - 9.3' H_2O. Total pressure drop of air across unit 0.265" W.G. All tubes of 90/10 CuNi alloy, 0.049"

wall thickness, and solder coated fins.

Spec.No. 4397 Reqn.No. 21058 P.O.No. 106-ALG-559 F.No. 10093

Magnet - 1H to Magnet -4H Dryer Magnets

Two Magni-Power Company double bank drawer grids, 11-3/4" long x 12-1/2" wide with six (6) 7/8" diameter x 12" long grid tubes on top row and five (5) 7/8" diameter x 12" long grids on bottom row. Units complete with housing and top and bottom mounting flanges per BFG Specification 5-4514, Page 2 of 2. All parts in contact with powder to be type 304 SS construction.

Spec.No. 4514 Reqn.No. 21317 P.O.No. 96-ALG-1329 F.No. 10176

PL-1H & PL-2H Venturi Dryer Feed Pulverizer

A squirrel cage type device consisting of 1/8" SS welding rods parallel spaced in a circle at 1" spacings inserted and welded into three 10 ga. 14" diameter SS plates; one plate on each end and one in the middle to form pulverizer cage. Driven by a 1/2 HP, 37 rpm, 440 volt, 60 cycle, 3 phase, Class I, Group D, U.S. Synchro-gear motor using Frame 56-7-6 Type DV-GW mounting position F-2. 1" motor shaft connected to 3/4" pulverizer shaft by a Lovejoy L-095 flexible coupling. Pulverizer shaft bearing - Sealmaster NP-12. B.F.Goodrich Dwg. G-10741.

Spec.No. G-10741 Reqn.No. 21247 P.O.No. 106-ALG-734 F.No. 10067

SCR-1H to SCR-4H PVC Resin Screeners

Rotex Model #42 Type A-AL/SS Screeners with capacity to handle 5000 lbs/hr. PVC powder through two 42 mesh screen in series. Particle size range of powder to screener 30-180 microns with traces of coarser material. Aluminum top cover, screen frame and spacer frame, SS bottom pan and box frame lining. V-belt drive using B.F.Goodrich belts and belt guards. Bottom pan arranged so that oversized material from both frames will discharge through common outlet. Both outlets 6" diameter. #351 Nitex Bolting Cloth with Bond Tite and aluminum grommets and

overall dimensions of 39" x 83" and 39" x 92". Motor - 2 HP, 1800 RPM, 440 volt, 60 cycle, 3 phase, Class I, Group D, explosion-proof motor with 184 frame. Overall length - 125-3/4". Overall height - 46-3/8".

Spec.No. 4381 Reqn.No. 20915 P.O.No. 106-ALG-395 F.No. 9972

SE-1H & SE-2H Slurry Feed Magnetic Separator

Eriez 2" pipeline model B-2 Ferrotrap with standard pipe thread connections. Overall length - 11". Trap nominal diameter - 5". Magnetic element consists of five magnetic fingers of 316 SS construction.

Spec.No. Reqn.No. 20850 P.O.No. 96-ALG-659 F.No. 9973

SE-3H & SE-4H Venturi Dryer 1st Stage Product Separator

Ducon size 280 type SDM Duclone, complete with outlet scroll, access door in cone, and dust trap. Reinforced for (-20") W.G. pressure operation. Metal in contact with resin of 304 SS; 11 ga. Capacity 11,000 cfm of 160°F air containing 84 lbs. per min. PVC and 2.8 lbs. per min. water vapor. Powder 30 to 180 microns with 90% larger than 50 microns sp.gr. 1.3 to 1.4 Operating pressure drop across unit - 5.1" W.G.

Spec.No. 4377 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9976

SE-5H & SE-6H Venturi Dryer 2nd Stage Product Collector

Ducon size 120 type SDM Duclone duplicates SE-3H & SE-4H except for design rate and size. Design rate - 4500 cfm of 160°F containing 84 lbs. per min. PVC resin and 1 lbs. per min. water vapor. Pressure drop at operating conditions - 4.9" W.G.

Spec.No. 4377 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9975

SE-7H & SE-8H Venturi Dryer 1st and 2nd Stage Dust Collector

Aerotec tubular dust collector, model 6UPV #7-70, with vertical bottom inlet and outlet. Construction - stainless steel. Air inlet and outlet and powder outlet flanged. Access panels for all compartments, pipe nozzles and caps above each row of tubes for air lancing. Tube sheet vertical rather than

horizontal. Tubes sloping at an angle towards powder discharge. Operating pressure -20" W.G. negative pressure and maximum pressure drop of 8" W.G. Precipitating tubes - 6-5/8" outside diameter standard tubing with 0.134" wall, all welded construction. Each tube equipped with eight inlet openings and directional guides at inlet to said openings and welded top and bottom to tube sheet. The sheet and outlet envelope - 1/8" steel plate. To handle 16,000 cfm of 160°F air containing 1.0 lbs/min. PVC dust in particle size range of 30 to 180 microns and sp.gr. of 1.3 to 1.4. Separating efficiency of 30 micron material 99.0% at 3.7" W.G. pressure drop.

Spec.No. 4374 Reqn.No. 21103 P.O.No. 106 ALG-617 F.No. 10064

SE-9H to SE-12H Storage Bin Dust Collectors

Carter Day Company #24RJ48 Day Filters without hoppers. Fabricated of 12 g. mild steel with all parts in contact with PVC epoxy coated. Complete with 2' high body extension fitted with interlaced 1/2" dia. SS rods spaced on 13" centers and welded to body. 1/2" HP, V.L.W.F. 118 Boston reduction with 1800 rpm, 220/440 volts, 60 cycle, 3 phase, Class I, Group D, Frame 56C motor. Dacron filter sleeves. Filter body flanged for direct connection to storage bin. 3A-6 pressure blower with 2 HP, 3600 RPM, 220/440 volt, 60 cycle, 3 phase, Class I, Group D, motor with frame no. 184.

Spec.No. 4398 Reqn.No. 20891 P.O.No. 106 ALG-376 F.No. 9091

SE-13H & SE-14H Cold Powder Conveying Cyclone

Ducon size 60 type SDM Duclone, complete with outlet scroll, access door in cone, and dust trap. Reinforced for (-20) W.G. pressure operation. Metal in contact with resin of type 304 stainless steel; 11 gage. capacity 2420 cfm of 120°F air containing 84 lbs/min. PVC powder of 50 to 180 micron particle size. Operating pressure drop access unit -6" W.G.

Spec.No. 4376 Reqn.No. 20975 P.O.No. 106 ALG-503 F.No. 9974

TK-1H to TK-4H Product Storage Bins

Fabricated by Graver Tank and Manufacturing Co., per B.F.Goodrich Dwgs. E-4130 and G-10724. Bin diameter 14'0" x 20'0" high erected on 14'0" diameter x 3'6" high base. Internal welds ground smooth for epoxy coating. All grating, Kerrigan 1" x 3/16" Type K-300. Base constructed with 8" C.S. pipe for fluidizing unit connections. All carbon steel surfaces exposed to PVC are epoxy coated. Grating bearing bars and bolts exposed to PVC of SS construction. That not exposed to PVC of C.S. construction. 1/4" base wall thickness. Each tank has two 8" nozzles with 150 lb. ASA pipe flange drilling and made of SCH 5 stainless steel. Three, each, 3/4" full pipe couplings for sampling and temperature indicator. Manway with hinged cover on top and side both. Capacity 92,400# PVC. Bin walls constructed of carbon steel with epoxy coating.

Spec.No. E-4130 Reqn.No. 21149 P.O.No. 66 ALG-228 F.No. 10127

"J" Flowsheet

EQUIPMENT LIST

BL-1J Tailings System Conveying Blower

New York Blower Company size N16P-5, CWUB, pressure blower in arrangement 4 with welded steel housing and 16" aluminum type P wheel. Capacity 800 cfm @ 19" W.G. and 5 BHP. Driven by 5 hp, 3500 rpm, 3/60/230-460 volt, explosion-proof, frame 184T motor.

Spec.No. 4641 Reqn.No. 21370 P.O.No. 106 ALG-826 F.No. 10296

BL-3J Blower for Packaging Conveyor

Roots-Connersville size 59AF rotary positive displacement air blower with cast iron housing and impellers. Unit complete with $1\frac{1}{2}$" relief valve, 3" Air-Maze model no. DA 105US-GN dry type filter with wool media, 3" flexible pipe connector, belt drive, and base. Capacity 300 cfm at 5.8 BHP and impeller speed of 1220 rpm. Driven by a $7\frac{1}{2}$ hp, 1750 rpm, 220/440 volt, 3 phase, 60 cycle, TEFC, explosion-proof, frame 213T motor.

Spec.No. _____ Reqn.No. 21762 P.O.No. 106 ALG-1041 F.No. 10383

CV-1J & CV-2J Pneumatic Conveying Systems

Two Granu-Flow pneumatic conveying systems each to transfer 15,000 lbs/hour. Equipment includes 2 - 5'0" I.D. x 4'4" straight side (50 ft^3) Granu-vessels, individual control panels, one blower, and one after-cooler. Units to be complete per B.F.Goodrich drawing 5 MHS-11947.• Current characteristics of all motors are 3 phase, 60 cycle, 440 volt.

Spec.No. 4337 Reqn.No. 21423 P.O.No. IP66 ALG-295 F.No. 10137

CV-4J Bagging Conveyor

B.F.Goodrich conveyor system, Granu-veyors, to supply 24,000 lbs/hour of PVC powder from any of six (6) storage bins to a bagging machine per B.F.G. Drawing 5GS-12103.

Spec.No. 4685 Reqn.No. 21676 P.O.No. IP66-ALG-368 F.No.

HPR-1J to HPR-4J Re-Screening Hoppers for Tailings

42" O.D. x 8'2" straight side fabricated of 3/16" carbon steel by A. Nabakowski Company. Bottom tapers to $4\frac{1}{2}$" O.D. in 4'0". Top cover plate is 46" O.D. 3/16" thick carbon steel.

Top Openings: 1-10" diameter hole with 13" O.D. - 3/16" thick cover plate, 1-5" diameter hole, and 1-5" opening with 10" flange drilled for 5"-150 lb. ASA flange.

Bottom Opening: 1-$4\frac{1}{2}$" opening with 9" flange drilled for 4"-150 lb. ASA flange.

Spec.No. E-4135 Reqn.No. 21667 P.O.No. 106 ALG-971 F.No. 10306

PK-1J PVC Product Packager

H. L. Stoker Dual-Spout Model "Stand-Aire" pressure chamber type bag packer, complete with 110 volt electrical controls with dust tight enclosures, all necessary air controls, air filter and lubricator for air controls and air cylinders. All parts in contact with product to be type 304 stainless steel.

Packer is complete with 2-18" diameter x 36" straight side pressure chambers, 2-12" diameter butterfly charging valves with operators, 2-3" diameter pressure vents, 2-special $5\frac{1}{4}$" inflatable sleeve type packer spouts, 2-automatic spout purge systems, 2-bag operated automatic packer start switches, 1-pants-leg type transition and surge hopper of type 304 stainless steel

as shown on Stoker Drawing T-4965 and 2-dust hood attachments for spouts. Two Sutorbilt Model 3M blowers complete with pressure relief valve, V-belt drive, extended base, inlet filter silencer, 3 HP, Class I, Group D explosion-proof, frame 184T motor, 3/60/440 volt with slide rails and factory mounted and aligned. Unit will package 6-10 50 lb. bags of product per minute with an accuracy of 95% ± 4 oz.

Spec.No. 4523 Reqn.No. 21420 P.O.No. 96 ALG-1420 F.No. 10310

PK-2G PVC Tailings Packager

St. Regis 106 FGS basic screw type filling and weighing machine including frame, scale beam, bag chair support, bag clamp assembly with feed chute gate assembly and pneumatic gate control. Filling tube and screw assembly are of stainless steel construction. Unit complete with 1 HP, 1800 rpm, 3/60/440 volt, Class I, Group D motor. Unit will package 1-3 50 lb. bags per minute of tailings with an accuracy of 95% ± 4 oz. to 6 oz.

Spec.No. 4524 Reqn.No. 21418 P.O.No. 96 ALG-1426 F.No. 10173

SCR-1J Tailings Sifter

Blaw Knox No. 333, Model M Bar-Nun Rotary sifter complete with aluminum box and cover, bottom panel, three sieve frames complete with ball carrier wire, one spacer and two trays all of type 304 stainless steel, rubber ball cloth cleaners, one sieve clothed with 20 mesh #860 Nitex and two sieves clothed with 42 mesh #351 Nitex, one set of inlet and outlet flexible connections with thimbles and clamps, and a ½ hp, 1800 rpm, Class I, Group D, explosion-proof, frame 56 motor.

Spec.No. 4640 Reqn.No. 21369 P.O.No. 96 ALG-1347 F.No. 10184

SE-1J & SE-2J Tailings System Product Collectors

Ducon size 25 type SDM Duclone complete with dust trap. Capacity of each unit is 800 cfm air at 4.1" W.G. Construction of 14 gage type 304 stainless steel. Dust trap enlarged to 24" diameter X 18" straight side.

Spec.No. 4642 Reqn.No. 21556 P.O.No. 106 ALG-918 F.No. 10297

TK-1J to TK-3J PVC Silos

B.F.Goodrich 15'0" O.D. x 37'6" straight side Granu-flow conveying silos, each with a capacity of 7000 ft^3. Silos fabricated from carbon steel and are constructed, tested and stamped for 30 psig operating pressure. Interior finish: sandblast and apply two coats (12 mils) of plasite #7122 coating. Exterior finish: sandblast and apply one coat of prufcoat P-50 primer.

The silos are supplied with all major items of equipment, auxiliaries and controls as shown on BFG drawing 5MHS-11986 including the control panels and appropriate selector switches.

Two separate blower packages, capable of supplying air to any two of the silos at any time are provided. Each blower package to consist of a 40 hp and 75 hp blower, and air heating and cooling coils. The coils have the capacity to heat 1600 cfm of air from 52°F to 140°F using 180 psig or cool 1600 cfm of air from 250°F to 140°F using 85°F cooling water.

Spec.No. 4621 Reqn.No. 21424 P.O.No. 66 ALG-294 F.No. 10136

VCS-1J Vacuum Cleaning System

Spencer vacuum producer rated at 250 cfm @ 7.0" Hg. vacuum complete with 10 hp, 3500 rpm, 440/3/60, Class I, Group D motor, connecting sleeves with clamps and cork mounting pads. Unit also includes 1-24" centrifugal hopper bottom separator with 6" level operated swing valve, 1-30" tubular bag hopper bottom separator with 8" level operated swing valve, 6-25' lengths of $1\frac{1}{2}$"

heavy duty vacuum hose with couplings and other required fittings.

Spec.No. 4706 Reqn.No. 21683 P.O.No. 106 ALG-865 F.No. 10304

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EQUIPMENT LIST

AG-1/TK-1W & TK-2W Agitators for Ferri-floc Tanks

Cleveland portable mixer, model no. CGB-1/3 complete with 8" diameter 3 blade propellers, 3/4" diameter x 35-1/2" long carbon steel shaft, clamp mount, and 1/3 HP, 1750 RPM, 3/60/220-440 volt, frame 56C, NEMA TEFC motors. Shaft speed of 420 rpm obtained by gear reducers. Shaft and propeller are rubber coated.

Spec.No. 4445 Reqn.No. 21108 P.O.No. 106 ALG-663 F.No. 10074

AG-1/WS-1W Agitator for Precipitator

A W. H. Smith speed reducer model 20V, ratio 358.9 to 1 with 1 hp, 220 volt, 3 phase, 60 cycle, 4 speed totally enclosed motor complete with 2-1/8" diameter x 13'9" agitator shaft, bottom steady bearing and impellers constructed of two 3'0" channels welded to a rod parallel to the sloping wall and each connected to the shaft by a 6'0" length of rod. Agitator assembly is located 3" from the bottoms of the tank.

The following shaft speeds can be obtained with the 4-speed motor:

	Motor	Shaft
1st Low Speed	600 rpm	1.67 rpm
2nd Low Speed	900 rpm	2.40 rpm
3rd High Speed	1200 rpm	3.34 rpm
4th High Speed	1800 rpm	5.00 rpm

Spec.No. G-10744 Reqn.No. 21146 P.O.No. 66 ALG-231 F.No. 6010

FIL-1W Fully Automatic Filtration Plant

Fully automatic package filtration plant consisting of one (1) R.P. Adams Model 1WF-238 Poro-Stone Filter, automatic control system, and filter-aid precoat system. Unit capable of filtering 200 gpm of Avon Lake City Water and designed to operate in parallel with existing 200 gpm R. P. Adams

automatic system for a total filtering capacity of 400 GPM.

The DMF-238 filter is constructed of EPOXY lined carbon steel and designed for 100 psig ASME Code pressure and contains 238 square feet of Poro-Stone filtering surface. Unit complete with pneumatically operated centerline butterfly valves and inlet and outlet pressure gauges. The filter and Precoat system consists of one (1) 36" dia. x 60" high steel-epoxy-lined precoat mix tank (TK-3W), capacitance type level probe and warning system for mix tank, Lightnin Model ND-1 portable mixer, necessary pneumatically operated centerline butterfly valves, and one (1) Worthington type 2CN52 filter air precoat pump (PU-1W). This pump replaces the existing smaller unit and will supply existing filters as well as the new filter with precoat recirculation.

Worthington type 2CN52 centrifugal pump is rated at 200 gpm @ 60' TDH complete with baseplate, coupling and 5 hp, 440/3/60, 3600 rpm, Class 1, Group D motor.

Automation accessories shall include free standing panel, ATC card operated program timer, and necessary auxiliaries.

Spec.No._____ Reqn.No. 21041 P.O.No. 66 ALG-199 F.No. 10085

FIL-2W & FIL-3W Activated Carbon Water Filters

Illinois Water Treatment Company Model 2CM-12084 activated carbon filter system to filter 400 gpm water. System consists of two 120" Dia. x 84" straight side steel filter tanks with Plasite #7122 lining and 100 psig ASME Code design. Each filter contains 400 cubic feet Illco Super-Carb activated carbon. System complete with two Brooks Bypass Type Flow Indicators, 6" steel interconnecting piping, and 6" Fisher Butterfly Valves required for alternate series operation.

Spec.No. 4425 Reqn.No. 21056 P.O.No. 66 ALG-188 F.No. 10365

PU-1W & PU-2W Ferri-floc Transfer Pumps

Milton Roy simplex diaphragm pumps R132 to delivery 0-17.9 GPH of 10% ferri-floc solution against a 20' head. Inlet and outlet connections are 1/4" NPT female. Each pump to be prepiped to individual feed tank and are of corrosion resistant construction. Motor 1/4 hp, 1750 rpm, 3/60/440 with a TENV enclosure.

Spec.No. 4445 Reqn.No. 21108 P.O.No. 106 ALG-663 F.No. 10073

PU-3W & PU-4W Caustic Transfer Pumps

Milton Roy FR120 simplex diaphragm pumps handle 6.2 gpm of 50% caustic solution against a 20' head. Suction connection is 3/8" NPT female and discharge connection is 1/4" NPT female. Driven by 1/4 hp, 1750 rpm, 3/60/440, Class I, Group D, frame NEMA 56C motor.

Spec.No. 4445 Reqn.No. 21108 P.O.No. 106 ALG-663 F.No. 10073

PU-5W & PU-6W Water Transfer Pumps

Goulds Model 3196, size 3 x 4 - 8G, Group M, 1 stage centrifugal pump with wetted portions of 316 SS construction. Complete with Crane type 9 QP1C1 mechanical seal, flange ratings - 150 lbs. ASA. Shaft packing - Teflon. Will deliver 400 gpm of 40°F of water at 210 feet TDH. At rating, BHP - 30.8, efficiency - 69%. Maximum BHP - 40. Impeller diameter - 7-3/8". Minimum/maximum impeller diameter, 5½/8-3/8. Rotation: right hand viewed from coupling end. NPSH available - 28'. NPSH required - 13'. Pump driven by a 40 hp, 3500 rpm, 440 volt, 60 cycle, 3 phase, explosion-proof, frame 324TS motor.

Spec.No. 4497 Reqn.No. 21329 P.O.No. 106 ALG-774 F.No. 10080

TK-1W & TK-2W

Fiber glass feed tanks 40" high and 40" dia. complete with metal stand, pedestal support and agitator mount. Tank to be covered but with provision for dumping bagged ferri-floc into top. All necessary piping for a Milton Roy R132 pump should be included.

Spec.No. 4445 Reqn.No. 21108 P.O.No. 106 ALG-663 F.No. 10074

Vacuum Chlorinator - 1W

Wallace & Tiernan series A-741 manual wall mounted chlorinator with a capacity of 50 lbs per day chlorine complete with: water & chlorine pressure gauges, 15' of polyethylene vent line, flexible connection for one cylinder, vent line screen and three wrenches.

Spec.No. 4512 Reqn.No. 21145 P.O.No. 96 ALG-1162 F.No. 9981

WS-1W Precepitator Tank

The precepitator tank is in the form of a frustrum of a cone. The sides slope from a 14'0" I.D. bottom to 23'0" I.D. at the top edge in a vertical height of 13'0". Bottom and sides are constructed of 1/4" thick carbon steel. A bearing box 4" deep x 14" square is provided in the bottom. A skirt of 3/16" thick carbon steel plate is welded to the top of the tank and slopes to an outside diameter of 9'9" at a vertical distance from the bottom of 2'0". The bottom of the skirt is welded to a 5" x 3-1/2" x 3/8" angle which has been welded in a 9'0" B to B.L. circle. A concentrator wall constructed of 3/16" thick carbon steel plate 2'0" wide is welded vertically to the 5" x 1/32" x 3/8" angle in a 9'1" circle. Eight 12" x 3'0" x 3/16" plate stilling baffles are welded to skirt plate at 45° intervals. This tank was originally purchased from Purmutit Co. for the original Henry installation by Blaw Knox and moved to the Avon Lake Plant in 1966.

Spec.No. G-10744 Reqn.No. 21146 P.O.No. _____ F.No. 6010

EQUIPMENT LIST

PU-1X & PU-2X Demineralized Water Transfer Pumps

Goulds Model 3196, size 3 x 4 - 8, Group S, 1 stage centrifugal pump with wetted portions of 316 SS construction. Complete with Crane type 9 QPICI mechanical seal, flange ratings - 150 lbs. ASA. Shaft packing - Teflon. Will deliver 400 GPM of 40°F water at 54.1 feet TDH. At rating, BHP - 8.55, efficiency - 64%. Maximum BHP - 9. Impeller diameter - 9-3/8". Minimum/maximum impeller diameter, 9". Rotation: right hand viewed from coupling end. NPSH available - 9.2'. NPSH required -

Pump driven by a 10 hp, 1750 rpm, 440 volt, 60 cycle, 3 phase, explosion-proof, frame 215T motor.

Spec.No. 4488 Reqn.No. 21126 P.O.No. 106-ALG-774 F.No.10079

PU-3X Demineralized Water Feed Pump

Peerless vertical industrial service pump, bronze construction, consisting of 4 x 6 x12 discharge assembly, 5" x 3/4" column and shaft assembly, and 4 stage 6LB vertical turbine pump bowl assembly. Complete with Crane type 9 QPICI mechanical seal, suction strainer, flange ratings - 125 lbs. ASA. Shaft packing - Teflon. Will deliver 200 gpm of 40°F water at 230 feet TDH. At rating, BHP - 16.6, efficiency - 70%. Maximum BHP - 17. Impeller diameter - 4-15/32". Rotation: Counterclockwise as viewed from coupling end. NPSH available - NPSH required - 16'. Pump driven by a 20 hp, 3600 rpm, 440 volt, 60 cycle, 3 phase, explosion-proof, hollowshaft, frame 286UP motor.

Spec.No. 4438 Reqn,No. 21312 P.O.No. 106-ALG-788 F.No. 10134

TK-1X D.M. Water Storage Tank

16'0" I.D. x 20'0" straight side tank fabricated in the field by GATC according to API Code 650. Cylindrical shell and 3/4" : 12" sloping roof constructed of 3/16" thick carbon steel plate. Bottom is constructed of 10.2 lb. carbon steel plate. Designed for atmospheric pressure at 150°F.

Top Openings: 1-20" manway with cover and 1-6" 150#ASA nozzle.

Shell Openings: 1-20" manway with cover, 1-6"-150#ASA nozzle, 3-4" - 150# ASA nozzles, 1-1" - 150#ASA nozzle, 4-2" D.F. nozzles.

Spec.No. 4492 Reqn.No. 21267 P.O.No. 106-ALG-783 F.No. 10361

TK-2X 150 Gallon Seal Water Tank

One vertical 150 gallon carbon steel tank 30" O.D. x 3'8" straight side fabricated by Industrial Metal Products Co. Design: 50 psig and full vacuum @ 450°F.

Spec.No. 4491 Reqn.No. 21342 P.O.No. 106-ALG-754 F.No. 10132

WS-1W to WS-3W Demineralized Water Systems

Cochrane demineralized water system consists of a dual bed strong cation-weak anion demineralizer capable of producing 200,000 gallons per day, a vacuum degasifier with a capacity of 400 gallons per minute, and a mixed bed polishing demineralizer capable of producing 200,000 gallons per day at an average flow rate of 160 gallons per minute and maximum flow rate of 200 gallons per minute.

All units are designed for automatic regeneration. Regeneration is initiated manually following alarm from either volume or conductivity meters. The regenerant addition system serves both the dual bed and mixed bed units, and interlocks are provided to prevent simultaneous regeneration of the units.

The dual bed demineralizer consists of one cation exchange unit of 100 psi ASME Code Construction containing 140 cubic feet of strong cation exchange resin, and one anion exchange unit of 100 psi ASME Code construction containing 53.3 cubic feet of weak base anion resin. The mixed bed demineralizer consists of one mixed bed exchange unit of 100 psi ASME Code construction containing 15 cubic feet of strong cation resin and 30 cubic feet of strong base anion resin. The vacuum degasifier consists of a 4'-0" dia. x 16'0" straight shell tower of 75 psi and full vacuum ASME Code construction, with a Fischer level controller, and a Schutte & Koerting 4" T-2 by 1½" S-3 two stage steam jet ejector with a No. 2 inter-condenser.

The in-line regeneration system consists of Milton Roy acid and caustic pumps complete with Class 1, Group D, explosion-proof motors, acid and caustic day tanks with Warrick high and low level probes, and necessary controls, automatic valves, and piping for automatic operation. Four regenerant level alarm lights are provided, two each located in dual bed and mixed bed control panels.

WARRANTY: The vendor guarantees that the dual bed demineralizer shall produce 200,000 gallons per day of water containing a Na ion content of not more than 1 ppm (as $CaCO_3$) when the feedwater composition is as recorded in specification S-4411 and proposal no. 40391. This guarantee applies when the unit is operated at an average flow rate of 160 GPM and a maximum flow rate of 200 GPM and regenerated not more than once in 24 hours. Chemical requirements shall not exceed 5 lb. of 100% H_2SO_4 per cu.ft. of cation resin and 2.5 lb. of 100% NaOH per cu.ft. of anion resin.

The effluent from the vacuum degassifier shall contain not more than 0.5 ppm O_2 and not more than 15 ppm CO_2 when treating effluent from the dual bed demineralizer at a maximum flow rate of 400 GPM.

The vendor guarantees that the quality of the mixed bed demineralizer effluent shall not exceed 1.0 micro mho conductivity and shall contain not more than 0.1 ppm silica (as Sio_2). The unit shall be capable of treating not less than 310,000 gallons between regenerations when operated at an average flow rate of 160 gpm and a maximum flow rate of 200 GPM. Chemical requirements shall not exceed 5 lbs. of 100% H_2SO_4 per cu.ft. of cation resin and 7 lbs. of 100% NaOH per cu.ft. of anion resin.

The vendor guarantees that the maximum loss of capacity below the guaranteed initial capacity shall not exceed:

Cation units: 3% per year for a period of 3 years after start of operation.

Anion units: 25% of the guaranteed initial capacity after 1,000,000 gallons have been treated per cubic foot of resin or after 24 months whichever comes earlier.

Spec.No. 4411 Reqn.No. 21027 P.O.No. 96-ALG-820 F.No. 10062

FLOWSHEET "B-1" TANK FARM

PRESSURE CONTROLLER - The pressure controller on the vinyl transfer pump is operated by sensing the pressure in the discharge line of the pump and controlling the steam to the pump. Since it is almost impossible to guarantee tight shutoff on steam valves, the operating personnel should be sure that the 1/2" bypass line from the discharge of the pump is open so that a small amount of steam will not raise the pressure in the line.

FLOWSHEET "C"

CHARGE SYSTEM - Weigh controls in this area are duplicates of those used previously in Building 461. Unless the weigh tank is to be emptied completely, a heel should always be left in this tank, then the amount called for by the recipe is added to the heel weight and this becomes the fill weight. The system will operate automatically as follows:

When the tank is to be emptied, a pushbutton located adjacent to the weight recorder is pushed and the amount of material shown between the two setpoints will be added to the charge line. When this amount has been discharged, the outlet valve will close, the nitrogen will vent off and the tank will re-fill to the set weight.

VCL CHARGING - The vinyl chloride will be metered through A.O.Smith meters which have automatic temperature compensation and automatic shutoff. Since the vinyl transfer pump is capable of pumping 400 GPM, a flow control valve has been installed ahead of the meter. This valve will have to be set on the first charge so that a flow rate of approximately 200 GPM is obtained. The back-pressure valve should be set at approximately 180 psig. This is to prevent vinyl flashing through the meter. This valve will only open when the memter has been set and the handle pulled to charge vinyl.

RECOVERED VCL CHARGING - Because of the past difficulties in using positive displacement meters on this service, the calibration tank will serve also as the recovered VCL charge tank. This tank has been equipped with a hydraulic tension cell whose output is converted to a pneumatic signal. By adjusting two air regulators the filling and emptying of this tank can be done automatically. To fill this tank a three-way air switch is turned so that an air regulator can adjust the index or weight pointer to the amount the tank is to be filled to. The three-way air switch is then returned to its normal position. By pushing the fill button the tank will automatically fill to the amount that has been previously set. To empty the tank the inner dial on the indicator is rotated so that the amount to be removed from the tank lines up with the weight indicator. The operator then turns the other three-way switch and adjusts the air regulator until the weight indicator reaches zero on the inner dial. He then returns the three-way switch to its normal position. To empty the operator now pushes the discharge button and the correct amount will be discharged from the tank. There is the possibility that this system may overshoot by a small amount and if this amount is objectionable, the operator should be instructed to subtract this amount from the amount shown on the recipe and use the new value to set opposite the weight indicator.

HIGH PRESSURE POLY CLEANING PUMP - The controls in this system will duplicate those used in Building 461 with the following exceptions: The pump discharge pressure can be set from the polymerizer floor area by adjusting a manual regulator. This was installed in this manner so that the pump discharge can be varied. This will be true especially if a Sellers Jet is added to this system. One additional precaution has been taken and that is there is one more pressure switch which should be set at approximately 4000 psig. Its tag number is SW-P-5C. The purpose of this switch is that if the pump pressure has been set higher than 4000 psig, the lance cannot be made operable. By reducing the setting on the pump pressure controller, the

switch will de-activate and the lance may be used.

DEMINERALIZED WATER CHARGING - This is an entirely new system to the Avon Lake personnel. Positive displacement meters could not be found that would operate at the high pressures and high flow rates desired. We have, therefore, installed a turbine meter which will generate pulses. These pulses will be sent back to the control room where they will be converted to a D.C. current. This D.C. current will be used to actuate the counter which is installed adjacent to the vinyl chloride meter. This same D.C. current is converted behind the panel to a pneumatic signal which goes to the flow controller which is mounted on the valve on the discharge side of the turbine meter. The setting on this flow controller should be 200 GPM. When the water counter has counted down to approximately 25 gallons, it will activate a micro-switch which will in turn operate a solenoid valve. This solenoid valve will switch the air signal to the control valve from the flow controller to a manual regulator. The ouput from the manual regulator should be approximately 4 lbs. This is our dribble or slow speed cutoff. When all the material has been delivered through the meter, another micro-switch is activated which will shut the valve. Vapor in either the water or the vinyl systems can cause high maintenance on the equipment. It is therefore required that the discharge valves on the system be opened slowly so that measuring systems are not subjected to rapid startups.

POLY DRIVE PURGE WATER AND POLY INJECTION WATER SYSTEM - The pumps supplying this water have a pressure control bypass to prevent the water from overheating. Riding on the line is a storage tank. This tank should always have 300 lbs. nitrogen pressure on it. If the line pressure falls below 300 psig, this will be caused by pump failure and the valve on the outlet of the surge tank will open and supply purge water until the spare pump is started. When the above occurs, an alarm will sound in the control room. The poly injection

water also works off the same pump system, but when the pressure drops, the injection water valves are close.

CALIBRATION OF VINYL AND WATER METERING - A 1000 gallon tank has been provided so that approximately 4 minutes of metering time can be had for the calibration of the vinyl and demineralized water meters. This is the same tank that is used for recovered VCL charging.

FLOWSHEET "D" - POLYMERIZER CONTROL

Each polymerizer has the following controls and starting from the bottom of the panel the first unit is a -

CAM PROGRAMMER - This unit has two programmers inside the case - one for each of the polys directly above. Once a cam is cut and put in place on the drum to start the programmer, move the lever at base of cam to bring starting time to zero. Also push the start button and hold in until the cam follower rises above the cam then release. The programmer will then transmit a pneumatic 3 to 15 psig air signal to the temperature recorder controller sub panel located above. The electric drive for the programmer will not start until the polymerizer temperature is within 2°F of the setpoint and then a switch will automatically start the programmer motor.

PRESSURE RECORDER - This recorder has a range of 30" Hg - 0 - 300 psig. and records polymerizer pressure.

SUBPANEL FOR TEMPERATURE CONTROL RECORDER - The bottom switch and regulator are related to the output of the cam programmer. The regulator on the right will modify the pneumatic signal from the cam unit. The multipoint temperature indicator on the center panel is always to be considered as correct and if the poly temperature record does not agree with the indicator, adjust the bottom regulator to raise or lower the setpoint of the controller to bring the two together. If the recorder controller setpoint is to be from the cam unit, the bottom switch should be on automatic. If the recorder controller's setpoint is to be manually set, the bottom switch should be on manual.

The top regulator serves two purposes. When the bottom switch is on manual the setpoint of the recorder controller is adjusted by this regulator. This is manual set. The second purpose is to manually regulate the control valves and it does this when the top switch is in the manual po . Only when the control valves are to be manually regulated should the top switch be on manual. For automatic control of the valves the top switch is on automatic.

The gage between the top regulator and switch shows the control air to the control valves at all times.

TEMPERATURE RECORDER CONTROLLER - This unit records polymerizer temperature on the red pen and jacket temperature on the green pen. For automatic polymerizer temperature control the auto-manual switch in this unit should be on automatic. The output air from the polymerizer controller is the setpoint for the jacket temperature controller. The pneumatic piping is such that the poly controller cannot directly control the valves. The jacket temperature controller's output goes to the control valves. Installed between these two controllers is a high limit relay which limits the setpoint of the jacket controller to 160°F. This is done to prevent water hammer when the polymerizer is heating up. There should never be a case when the jacket temperature should be controlled manually, therefore, the auto-manual switch on the controller should always be on automatic. After a polymerizer has been blown down or it is desired to cool a poly down manually, turn the top switch on the subpanel to manual and adjust the regulator to open the water valve. With an air signal of 15 psig the steam valve is wide open and the water valve is closed. At 9 psig both valves are closed and at 3 psig, the water valve is wide open and the steam valve is closed.

AMMETERS - Each motor has its own ammeter to indicate the agitator motor load.

PUSH BUTTONS - Each motor has its own start-stop button on the panel.

ALARM PANEL - This unit has an alarm for high polymerizer temperature, motor failure or oil pressure failure, and for low seal oil pressure.

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A red light indicates an alarm condition and the horn will sound. After pushing the acknowledge button, the red light will go off and a white light comes on. When conditions return to normal, the white light goes out, but the horn does not come on. On normal, both red and white lights are dim so that the operator can tell if a bulb is burned out.

An additional feature has been provided in this alarm system. When the agitator motor has been turned off by the push button the alarm for motor failure and oil pump failure will not be activated.

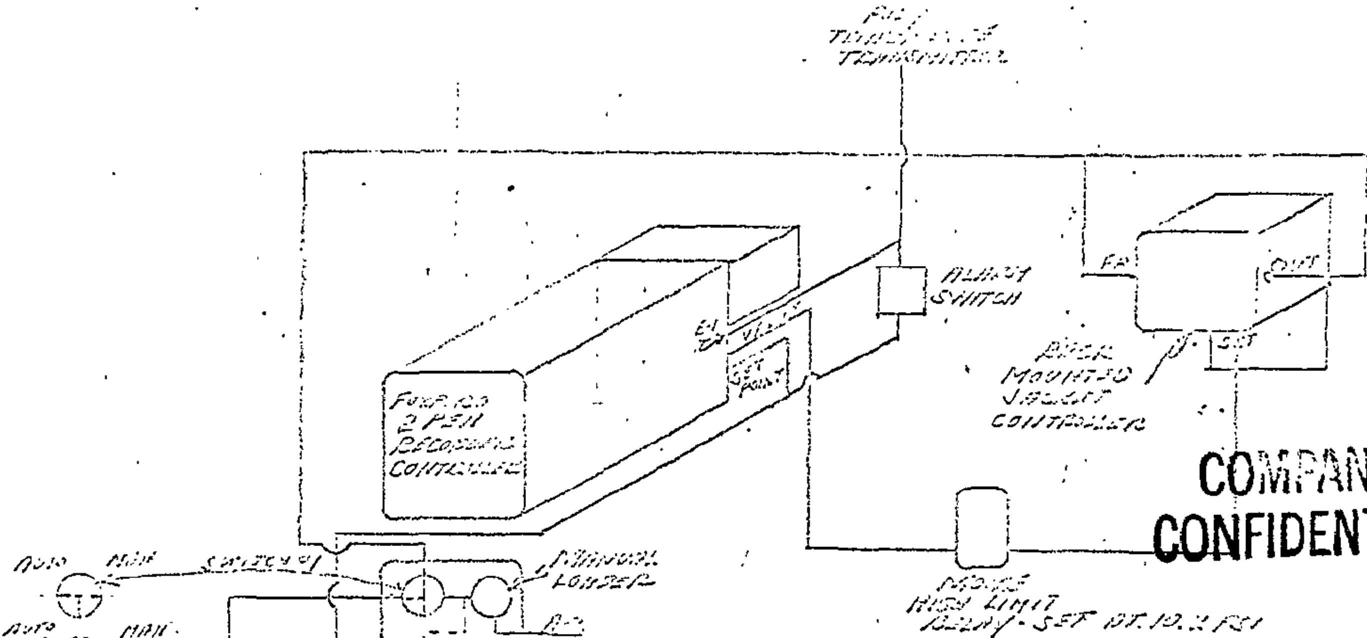
BLOWDOWN TANK STRIPPING - When the operator desires to heat a blowdown tank it will be necessary for him to set a temperature controller which is located on the second floor adjacent to the blowdown tank, and then activate the system by pressing the heat-up button on the control panel. This control panel is a common alarm and recorder panel for all blowdown tanks. The tank will then heat up to the setpoint temperature, and when it reaches this temperature the block valve on the steam line mounted directly on the bottom of the blowdown tank will close. This valve will stay closed until the operator pushes the heat-up button again. When this valve closes, an alarm will sound so the operator will know that the blowdown tank is at the temperature. This system is designed so that the operator will know when the tank has reached temperature, also so that steam will not sparge into the tank once the desired temperature has been reached.

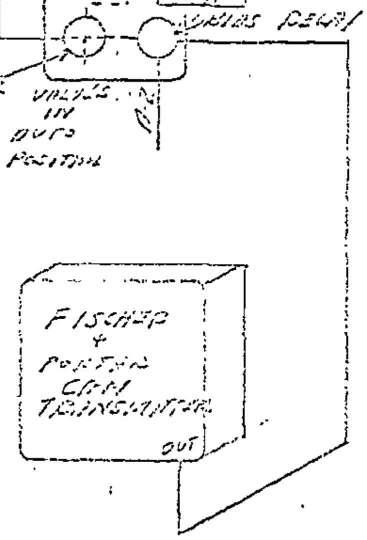
FLOWSHEETS "G" AND "H"

VENTURI DRYERS - The venturi driers are controlled in the same manner as before with temperature control on the outlet controlling steam valves on the heaters. The centrifuge is controlled by torque. The operator sets the desired torque on the unit and the controller operates a Vee-ball valve on the slurry to the centrifuge. The Vee-ball has proven to give excellent control, and difficulties previously encountered in torque control have been eliminated. There are two alarm settings on this controller. The lower setting shuts off slurry feed until the torque falls below its setpoint,

and there is a time delay in this circuit. The higher torque setting shuts off the centrifuge. This is to prevent the shear pin from breaking.

[illegible] General [illegible]
Polymerizer Pneumatic Circuit and Operation
of Subpanel Switches & Air Loader
Bldg 464





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OPERATION,

To manually control valves
1. Put switches #1 & 2 in manual position
2. Adjust manual loader & read air to valves on gage between #1 switch & manual loader;
   0 on gage = 3 PSI
   50 on gage = 9 PSI
   100 on gage = 15 PSI

To manually put set point to recording controller
1. Switch #1 on [illegible]
2. Switch #2 on man set
3. Adjust manual loader to desired set point

To cam set set point [illegible] controller
1. Switch #1 on auto
2. Switch #2 on auto set
3. Hold cam [illegible]
   cam follower is [illegible]
4. If cam set point does not agree with [illegible] point indicator adjust bias relay

Note: Auto [illegible] switch on [illegible] recorder controller should always be in automatic position

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DJ [illegible]
3/16/67 [illegible]

NGC35996

AN	Tag	Location	P.O.	Mfg.	Alarm
	D-1 thru 5	Poly Panel	106-ALG-583	Electro Devices	Normal conditions
	C-1	Dryer	"	"	alarm to be-de-energized
	H-1, 2	Dryer	"	"	" "

CAM-T	Tag	Location	P.O.	Mfg.	Scale Range	Signal Output	Type
	D-PLY-1, 2 thru PLY-15, 16 -1	Poly Panel	106-ALG-685	Fisher & Porter	75-175 °F uniform	3-15 psig.	Duplex

CD-RA	Tag	Location	P.O.	Mfg.	Range	Chart	Alarm
	C- /HE-1 -1	Poly Panel	66-ALG-173	Foxboro	0 - 3 microm.oes	1 rev/24 hrs.	close for alarm

CD-T	Tag	Location	P.O.	Mfg.	Pressure Rating	Alarm
	C- /HE-1 -1	D-M Water Tank	66-ALG-173	Foxboro	125 psig	close for alarm

FC	Tag	Location	P.O.	Mfg.	Size	Flow Rate
	C- /HE-1 -1	Water Flow to D-M Water Tank	76-ALG-1594	Blott-Robb	2"	Normal, 100 GPM ; Adjustable 75-125 GPM
	C- /MV-1, -2 -1	Charging VCL Flow	96-ALG-1135	Blott-Robb		
	F- /CM-1, 3 -1, /CM-2, 4 -2	Seal and Purge Water Flow To Compressors	76-ALG-2176	Dole Valve Co.	Model	Connections / Flow
					5G	3/4" FNPT / 5 GPM
	F- /CM-1, 3 -5	"	"	"	5G	3/4" FNPT / 5 GPM
	F- /CM-9 -1	"	"	"	10G	3/4" FNPT / 10 GPM
	F- /CM-1, 3 -4	"	"	"	10G	3/4" FNPT / 10 GPM
	F- /CM-2, 4 -4	"	"	"	15GX	1" FNPT / 15 GPM
	F-/CM-2,4 -1	"	"	"	25GX	1" FNPT / 25 GPM
	F- /CM-1, 3, 9 -2	"	"	"	1/8G	3/8" FNPT / 8 GPM
	F- /CM-1,2,3,4,9 -3	"	"	"	1/8G	3/8" FNPT / 8 GPM
					1/8G	3/8" FNPT / 8 GPM

FCI	Tag	Location	P.O.	Mfg.	Model	Fluid	Range	Normal	Pressure rating,psi	Size
	C- /MV-3,4 -1	D-M Water Charge Flow Control w/MV-1 -1/MV-3C,4C	76 ALG-2435	Fisher Governor		Water	0 - 250 GPM			
	F- /RF-1 -1	Refrigerated Water Flow	66 ALG-411	Lester Johnson (U.S.Gauge)		Air	3-15 psig		3-15	
	D- /PLY-1 thru 16 -1	Injection Water	96-ALG-1063	Brooks	1306-8810	Water			200 psig	8
	-2	Poly Seal Water	"	"	1300	Water			300 psig	6
	D- /PU-1 thru 4 -1	Seal Water	"	"	1350-8800	Water	Flow 0.5 to 4.0 GPH		100	4

FCI	F.S. Tag	Location	P.O.	Mfg.	Model	Fluid	Range	Normal	Pressure rating, psi	Size
	E- /PU-1 thru 4									
	-1	Seal Water	96-ALG-1063	Brooks	1350-8800	Water	flow 0.5 - 4.0 GPH		100	4
	E- /TK-1 thru 6									
	-1	Agitator Seal Water	"	"	"	"	"	"	"	"
	F- /PU-3, 4, 7									
	-1	Pump Seal Water	106-ALG-1120	Brooks	ShoRate 50	Water	4 GPH, max.			
	U- /DR-1									
	-1	Instr.Air Dryer Flow	76-ALG-1698	Fisher		Air	0 - 250 SCFM			
	U- /WCT-1									
	-1	Level Control, Air	96-ALG-1333	Brooks	1350-8800	Air	flow 0.5 to 5.0 CFH		35 psig	1/4" NPT
	W- /TK-4									
	-1	Level Control Air	146-ALG-484	Brooks	1350-8800	Air	flow 0.5 to 5.0 CFH			
	W- -1	Filtered Water Flow (FIL-1W)	106-ALG-923	Industrial Inst.	IIC 200-6S	Water	100" water, Scale 0-500 sq.rt.			1/2" NPT

	F.S. Tag	Location	P.O.	Mfg.	Type	Differential	Output	Range
F-CR	W- /WS-1							
	-1	Water To Clarifier	66-ALG-278	Foxboro		100" w.c.	Pulse	0 - 500 GPM (14AEP Integrator)
F-CR/P-R	F- /CN-1							
	-1	Recovered VCL Flow Rate	66-ALG-393	Foxboro	5422TS/58P4F	50" w.c.		0 - 30 sq.rt. 3-15 psig 0-30,000 #/hr.

FG	F.S. Tag	Location	P.O.	Mfg.	Style	Size	Pressure Rating	Mtl.
	D- /PLY-1 thru 16							
	-1	Manual Vent Flow	106-ALG-665	Schutte & Koerting	1802X	1/2"	300 psig	s.s. 316, teflon gasket, bronze exterior, retiaining rings
	F- /SE-5							
	-1	Separator Drain	96-ALG-1464	Jacoby-Tarbox	608F	1 ½"	150# flange	316 s.s. w/teflon gaskets
	U- /CM-1							
	-1	Cooling Water Flow	146-ALG-457	Jacoby-Tarbox	300-S	1½" NPT screwed	rotary type	Iron w/Neoprene gaskets
	-2, -3	" "	"	"	960-F	2" - 150# flg.	rotary type	Steel w/Neoprene gaskets

FI	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Liquid	Size	Scale
	D- /POLY-16								
	-1	Cooling Water Top Head	106-ALG-923	Industrial Instr.	200-6	100"	Water	1/4" NPT	0-5 sq.r.t. Scale x 10 -GPM
	-2	Cooling Water Jacket	"	"	"	"	"	"	0-500 sq.rt.
	-3	Cooling Water Baffle	"	"	"	"	"	"	0-70 sq.rt.
	G- /BL-3								
	-1	Total Air Flow (DR-1G)	106-ALG-728	Meriam	M-167 (Pitot Tube) 30" L dimension 40GC4 (Manometer) 0-1" w.c. Provide unity oil			3/4" NPT (process) 1/8" NPT (Instrument)	
	G- /DR-2								
	-1	Second Stage Air Flow (DR-2G)	106-ALG-728	Meriam	40GC4 (Manometer) 0-2" w.c. Provide unity oil M-167 (Pitot Tube) 25" L dimension			3/4" NPT (process) 1/8" NPT (Instrument)	
	H- /DR-3, -4								
	1	Second Stage Air Flow (H Dryers)	106-ALG-728	Meriam	40GC4 (Manometer) 0-1" w.c. Provide unity oil M-167 (Pitot Tube) 25" L dimension			3/4" NPT (process) 1/8" NPT (Instrument	
	H- /BL-5, -6								
	-1	Total Air Flow (H Dryers)	106-ALG-728	Meriam	40GC4 (Manometer) 0-1" w.c. Provide unity oil M-167 (Pitot Tube) 25" L dimension			3/4" NPT (process) 1/8" NPT (Instrument)	

	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Liquid	Size	Scale
FI	G- /CE-1	D-M Water Flow							
	-1	G Dryer Centrifuge	96-ALG-896	Brooks	1140	5 GPM Normal	Water	10	
	H- /CE-1	D-M Water Flow							
	-1	H Dryer Centrifuge	"	"	"	"	"	"	
	H- /CE-2	" "							
	-1	" "	"	"	"	"	"	"	
	F- /CM-9								
	-1	Seal and	106-ALG-975	Wallace & Tiernan		15 GPM max flow		1"	FLT #1-G-12VI, Tube #1-40-G10
	-2	Purge Water	"	"	NA1207A	"			FLT #NP-300, Tube #NPXA-145
	F- /CM-1, -3	Seal and Purge							
	-1	Water Flow	"	"		40 GPM max. flow		1½"	FLT #1½"-G-16VI, Tube 1½"-40-C-10
	-2	"	"	"	NA1207A	15 GPH max. flow			FLT #NP-300, Tube #NPXA-145
	-3	"	"	"	NA1207A	15 GPH max. flow			FLT #NP-300, Tube #NPXA-145
	F- /CM-2, -4	"							
	-1-	"	"	"	NA1207A	15 GPH max. flow			FLT #NP-300, Tube #NPXA-145
	-2	"	"	"	"	"			" "
	-3	"	"	"	"	"			" "
	F- /SE-1,-2,-3,-6	Spray Water							
	-1	To Separators	"	"	NA1207A	15 GPH max. flow			FLT #NP-300, Tube #NPXA-145
	U- 1	Treatment Addition Flush Water	106-ALG-1120	Brooks	1110	13.65 GPM	Water	3/4" NPT	Carbon Steel end fittings Teflon Packing Tube Length 127 mm.

	F.S. Tag	Location	P.O.	Mfg.	Model	Connections	Cartridge
FIL	C- /PU-5C						
	-1	Instrument Air Filters	146-ALG-188	V.L.Towner	IBIG-2239-B3 CUNO	1/2" NPT	5 micron 2-3/4" x 4-7/8" Cast Iron & Steel
	-2	High Pressure Pump	"	"	"	"	" "

	F.S. Tag	Location	P.O.	Mfg.	Model	Range
FR	S- /1	Boiler Steam Flow Meter	66-ALG-401	Foxboro	40	3 - 15 psig 0 - 30 sq.rt. 8 digit non reset type Integrator

	F.S. Tag	Location	P.O.	Mfg.	Type	Differential	Output	Range
FT	F- /CN-1, -1 /CN-3 -1	Recovered VCL	66-ALG-374	Foxboro	13A D/P Cell			Adj. 20 to 205" w.c. set at 50" w.c.
		Vent Gas	66-ALG-401	Foxboro	D/P Cell		3 - 15 psig	Adj. 20 tp 205" w.c. set at 50" w.c.
	F- /RF-1 -1	Refrig.Water Flow	66-ALG-416	Taylor Instr.	200TD1103		3 - 15 psig	100" Water
	U- /DR-1 -1	Instrument Air Flow To Dryer	66-ALG-236	Foxboro	13A D/P Cell		3 - 15 psig	Adj. 20 - 205" w.c. set at 100"
	W- /WS-1 -1	Water To Clarifier	66-ALG-236	Foxboro	13A D/P Cell		3 - 15 psig	Adj. 20 - 205" w.c. set at 100"

	F.S. Tag	Location	P.O.	Mfg.	Model	
GAR	F- /CN-3 -1	Poly Panel	146-ALG-409	Beckman Instruments	L&N Speedomax H Model S	1"/Hr 200 Ft. Cable
GAT	F- /CN-3 -1	Poly Panel	"	"	778	0 - 100% O_2

GC	F.S. Tag	Location	P.O.	Mfg.	Model	Connections		
	C- /TK-21 -1	Emergency Seal Water Tank	76-ALG-1598	Jerguson Gage	215RCH12	3/4" - 300# flange		Center to Center 32 1/8"
	F- /CM-2, -4 -1	Compressor Seal Tanks	76-ALG-2805	Jerguson Gage	215R12-147	1/2"	40 psig	Center to Center 39½"
	S- /1, -2	Low Pressure Condensate Receivers-Dryer Bldg.	"	"	Tubular	3/4"	40 psig	Center to Center GC-1S 2'10"; GC-2S 2'0"

INT	F.S. Tag	Location	P.O.	Mfg.	Model	Input	Mounting	Counts/Hr	Factor Tag
	F- 1	Poly Panel	66-ALG-124	Foxboro	14A	3 - 15 psig	Flush on 1/2" th.panel	1000	Counts x 0.1 -#/hr.

LA	F.S. Tag	Location	P.O.	Mfg.	Model	Action		
	F- /DE-1 -1	Recovered VCL Decanter	66-ALG-377	Instruments, Inc.	Capacitance Probes	1" NPT	Normal 30 psig Max. 150 psig	40°F - 100°F
	F- /TK-1, -2 -1	Recovered Vinyl Chloride Storage Tank	"	"	"	"	"	" "
	U- /WCT-1 -1	Cooling Tower Sump	96-ALG-1687	Good Tech (United Electric) Type J6 Stock #9501		0 - 50" Water	4½ plus or minus 1¼" w.c.	

LC	F.S. Tag	Location	P.O.	Mfg.	Type	Range	Size
	C- /TK-21 -1	Emergency Seal Water Tank	106-ALG-508	Moore Pdts	25C430	3 - 15 psig	4" 300# flange Ball Float 3½" s.s.
	F- /CM-2, -4, -9 -1	Recovered VCL Compressors	146-ALG-321	Fisher Governor	2500-259B		1½" 150# flg. Float 304 s.s. 14" long
	F- /CN-3 -1	Liquid VCL From High Pressure Vent Condenser	66-ALG-330	Moore Pdts.	25S415C	3 - 15 psig	Float 3½" 316 s.s. Conn. 1½" NPT
	F- /TK-3, 6 -1	Level Control Seal Water Storage	66-ALG-330	Moore Pdts.	25C415	3 - 15 psig	4" - 150# flange Float 3½" 316 s.s.
	F- /SE-5 -1	Level Control	66-ALG-330	Moore Pdts.	25C415	3 - 15 psig	4" - 150# flange Float 3½" 316 s.s.
	S- 1 & -2	Level Control-Condensate	77 ALG-688	Fisher Governor	249B-2500-2		1½" NPT Upper and lower side

LCI	F.S. Tag	Location	P.O.	Mfg.	Range		
	C- /TK-20 -1	D-M Water Storage w/V-D-2/HE-1C	76-ALG-1502	Fisher-Governor	0-100% 3 - 15 psig Input		
	D- /TK-7 -1	Cooling Tower Return From Poly Heads	66-ALG-246	Lester Johnson (U.S.Gage)	0 - 100 unif,		1/4" NPT Element 0 - 3 psig bronze diaphragm
	U- /WCT-1 -1	Cooling Tower Level Control	66-ALG-246	Lester Johnson (U.S.Gage)	0 - 100 unif,		1/4" NPT element 0 - 3 psig bronze diaphragm
	X- /TK-1 -1	Bldg. 451 D-M Water Storage Tank	66-ALG-246	Lester Johnson(U.S.Gage)	0 - 100,unif,	3 - 15 psig	1/4" NPT Connection Proportional Control
	W- /TK-4 -1	Clarified Water Storage Tank Level Control	66-ALG-367	Lester Johnson (U.S.Gage)	0 - 3 psig, Dial 0 - 100 unif.		Control, Proportional, Element Ni-SPan-C

LI	F.S. Tag	Location	P.O.	Mfg.	Type	Mtl.	Level Indicated	Range
	C- /TK-20 -1	PanelBoard D-M Water Storage Tank	76-ALG-1433	Ashcroft	1377A-XPR			3 - 15 psig 0 - 100
	F-/TK-1, -2 -1	Recovered VCL Tank Levels	76-ALG-2322	Ashcroft	1379A-XPR	1/2" NPT back connected		3 - 15 psig, Dial 0 - 100 unif.
	S- 1	Fuel Oil Storage Tank	76-ALG-1603	VAREC	2500, "B"	Mfg. Std.		2- 1¼" coupling 1- 1½" coupling
LT	F.S.Tag	Location	P.O.	Mfg.	Type	Mtl.	Range	
	C- /TK-20 -1	D-M Water Storage Tank	106-ALG-510	Foxboro	13A D/P Cell	s.s.	Adj. 20 to 205 w.c. set at 205" w.c.	3 - 15 psig
	F- /TK-1, -2 -1	Recovered VCL Tanks	66-ALG-326	Foxboro	13LA D/P Cell	c.s. body, s.s. dia.	Adj. 20 to 205" w.c. set at 144" w.c.	3 - 15 psig.
	X- /TK-1 -1	Bldg. 451 D-M Water Storage Tank	66-ALG-236	Foxboro	13LA D/P Cell	stainless Steel	Adj. 20 - 205" w.c. set at 205"	
MV	F.S. Tag	Location	P.O.	Mfg.	Size			
	C- 1, -2	VCL Charge Meter	96-ALG-1135	Blott-Robb	3"	with control valve and strainer (wetted surfaces free of copper or aluminum or alloy)		
	C- 3, -4	D-M Water Charge Meter	96-ALG-1343	A.O.Smith	2"	Turbine, Range 20-240 GPM, 10-275 GPM; Model 581 Digital to Analog Convertor		
	C- 5	Cold Water Charge Meter	96-ALG-1324	Blott-Robb	1½"	Neptune S, Capacity 100 GPM Max, 75 GPM Normal with strainer		
OR	D-/PLY-1 thru 15 -1, -2	Restriction Baffle Water Flow	106-ALG-550	Meriam Instrument	1½" - 150# flanges, 1/8" thickness, Bore: 0.50"			
	D-/PLY-16 -1, -2	Restriction Baffle Water Flow	106-ALG-550	Meriam Instrument	1½" - 150# flanges, 1/8" thickness, Bore: 0.75"			
	-4	Measurement Cooling Water Flow	106-ALG-834	Daniel Orifice	6". Sch. 40 - 300# flange Tap 1/2" NPT, Bore: 4.185" concentric			
	-3,	"	"	"	2" Sch. 5 - 300# flange Tap 1/2" NPT, Bore: 1.179"			
	-5	"	"	"	2" Sch. 5 - 300# flange Tap 1/2" NPT, Bore: 1.366"			
	F- /CM-2, -4 -1	Restriction Orifice	146-ALG-541	Meriam Instrument	1½" 150# flange	Bore: 0.75"		
	-2	Recovery Compressors	"	"	4" - 150# flange	Bore: 1.50"		
	F- /CM-1 -1	Recovered VCL Orifice	146-ALG-562	Meriam Instrument	8" - 300#	Bore: 5.379"		
	F- /CM-3 -1	Vent Gas Orifice	146-ALG-562	Meriam Instrument	2" - 300#	Bore: 0.548"		
	F- /RF-1 -1	Recovery Chilled Water	76-ALG-2602	Meriam Instrument	6" - 300#	Bore: 3.942" concentric		
	S- /1	New Steam Header	146-ALG-562	Meriam Instrument	12" - 300#	Bore: 5.274"		
	S- 2	New Boiler	76-ALG-2313	Ohio Pipe & Supply	8" - 300#	Weld Neck, Extra Heavy Bore		
	W- 1	Filtered Water Flow	106-ALG-834	Daniel Orifice	6" - 300#	Bore: 3.657" concentric		
	W- /WS-1 -1	Clarified Water Flow	76-ALG-1733	Good Technical	6" - 300#	Bore: 3.658"		
	U- /DR-1 -1	Instr.Air Flow To Dryer	76-ALG-1733	Good Technical	2" - 300#	Bore: 0.9696"		
ORF	W- 1	Orifice Holder Filtered Water	106-ALG-834	Daniel Orifice	6" - 300#	Bore: 3.657"		

PA	F.S.Tag	Location	P.O.	Mfg.	Type	Model	Range	Differential
	C- /TK-21							
	-1	Seal Water Pressure	96-ALG-776	United Electric Controls	J-95 Stk. 9577	362	0 - 350 psi	6 plus or minus 2
	D- /PLY-1 thru 16							
	-1	Poly Panel	"	"	J-6 Stk. 9508	142	0 - 18 psi	5½" pl. or mi. 1½"
	-2	Poly Drive Librication	"	"	J-95 Stk. 9683	252	0 - 10 psi	1 psi pl.or mi. 1/4 psi
	-3	Poly Seal Pressure	"	"	J-95 Stk. 9577	362	0 - 350 psig	6 pl.or mi. 2 psi
	D- /BL-1							
	-1	Evacuation Blower	96-ALG-1180	"	J-96 Stk. 9945	126	0-30" Hg-Vac.	1/2" Hg.
	D- /TK-1 thru 6							
	-1	BlowDown Tank Pressure	"	"	J-95 Stk. 9577	362	0-350 psig	6 pl.or mi. 2"
	U- /1	Factory Air Poly Panel	96-ALG-1179	"	J-6 Stk. 9568	270	0-200 psi	3½"
	U- 2	Instr.Air Poly Panel	"	"	J-6 Stk. 9529	152	0-50 psi	5½" ounces
	U- 3 ,-4	Cooling Water&Steam Poly Pnl	"	"	J-6 Stk. 9508	142	0-18 psi	5½ w.c.
	U- 5	Poly Fog Nozzle Pressure	106-ALG-1112	"	110	164	0-200 psig	
	F- /CN-3	Vent Gas Pressure						
	-1	Poly Panel	96-ALG-1571	United Electric Controls	J-6 Stk. 9508	142	0 - 18 psi	

PCI	F.S. Tag	Location	P.O.	Mfg.	Range Psig	Control	Element	Action
	B-1/ 6	Tk.Fm. VCL Charge Pump	76-ALG-2593	Fisher-Governor	0-300	prop. and reset		
	C- /PU-6, -7	Calibration Tank Pumps						
	-1	Back Pressure	76-ALG-2593	"	0-300			
	F- /TK-6	Recovered Seal Water						
	-1	Tanks Equalization	76-ALG-2267	"	30" Hg-0-15 psig			
	C- /MV-1, -2	(mounted on V-D-1/MV-)	76-ALG-1502	"	0 - 300 psig.			
	-1	VCL Charge Back Pressure						
	C- /PU-3, -4	Poly Seal Water Pumps						
	-1	Back Pressure	76-ALG-2435	Fisher-Governor	0 - 600 psig			
	C-PU-5							
	-1	Hi Pressure Cleaning Pump	106-ALG-846	Lester Johnson(U.S.Gage)	0 - 7500 uniform scale 3 - 15 psi element prop. & reset control			
	C- /TK-21							
	-1	Injection Water Control	76-ALG-1502	Fisher Governor	0 - 400 psig			
	S- /1	(on V-D-1S) Boiler Gas Reducing	76-ALG-1934	Fisher Governor	0 - 30 psig			
	U- /DR-1							
	-1	Factory Air Boiler House	76-ALG-1698	Fisher Governor	0 - 200 psig			
	-2	Instr.Air Boiler House	"	"	0 - 60 psig			
	X- 1	(on V-D-1X) Filter Inlet Pres.Ctr.	76-ALG-1698	"	0 - 100 psig			
	X- 2	(on V-D-4X) Mixer Ded Pres.Ctr.	76-ALG-2267	"				
PCRA/F-R	F -/GN-3	Panel	66-ALG-206	Foxboro 5412TS/58P4	0 - 100 unif.			
	-1	Recovery System Vent Gas						
PCR/P-R	F- /CM-1, -3		66-ALG-339	Foxboro 5422TS/58P4	0 - 15 psig 30" Hg-0-30 psig #53152			
	-1	VCL Charge						

PI	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Matl.	Seal	(All 4½" Dial, Accuracy 1/2 of 1%, 1/2" NPT conn. blow-out disc micrometer adjustment)
	B-1 - 34, ..	VCL Charge Pump Tank Farm	76-ALG-2532	Ashcroft	1320B	0 - 200 psig	Steel	no	
	B-1 - 36, -37	VCL Accumulators	77-ALG-246	Ashcroft	1320S	0-300 psig	316 s.s.	no	
	B-1 - 35	VCL Charge Pump Steam Pres.	76-ALG-2838	Ashcroft	1320B	0 - 200 psig	Steel	no	

PI	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Matl.	Seal	(All 4½" Dial, Accuracy 1/2 of 1%, 1/2" NPT bottom connection, blow-out disc micrometer adjustment)
	C- /MV-1								
	-1	VCL Meter	76-ALG-1298	Ashcroft	1320B	0-300	Alloy Steel	no	
	C- /MV-3, 4								
	-1	D-M Water Meter	"	"	1320S	0-300	s.s.	no	
	C- /PU-1, -2								
	-1	D-M Water Pumps	"	"	1320S	0-300	s.s.	no	
	C- /PU-2	Cold Water Makeup to							
	-2	PU-1 & 2C	77-ALG-340	"	1320S	0-15	s.s	no	
	C- /PU-3, -4								
	-1	Seal & Injection Water Pumps	76-ALG-1298	"	1320S	0-400	s.s.	no	
	C- /PU-6								
	-1	Calibration Tank Pump	"	"	1320S	0-400	s.s.	no	
	C- /TK-16 thru 19								
	-1	Catalyst & Calibration Tanks	"	"	1320S	0-400	s.s.	no	
	C- /TK-19								
	-2, -3	Recovered VCL Filter	77-ALG-222	"	1320AC	30"-0-150	s.s.	M&G AA	
	C- /TK-21 thru 23	Seal Water, Nitrogen							
	-1	Storage, Short Stop Tanks	76-ALG-1298	"	1320S	0-400	s.s.	no	
	C- /V-PA-1								
	-1	Reduced Nitrogen	"	"	1320B	0-300	Alloy Steel	no	
	C- /PU-5								
	-1	Hi Pressure Cleaning Pump	96-ALG-959	Robertshaw Acragage S-472D		0-7500	Case: Type 72 cast iron, Tube: Alloy Steel		
	D- /PLY-1 thru 16								
	-1	Poly Pressure	76-ALG-1298	Ashcroft	1320AC	30"-0-300	Brass	1"-300# flg.	
	-2	Rupture Disc Pressure	"	"		30"-0-30#	Bronze	No 2½" 1004	
	-3	Seal Pressure	"	"	1320B	0-400	Alloy Steel	no	
	D- /PU-1 thru 4								
	-1	Slurry Pumps	76-ALG-1298	"	1320A	0-60	Brass	1" - 150# flange	
	D- /PU-5								
	-1	Cooling Tower Return Pump	76-ALG-1905	"	1320A	0-60	Brass	no	
	D- /TK-1 thru 6								
	-1	BlowDown Tank Pressure	76-ALG-1298	"	1320AC	30"-0-300	Brass	1" - 150# flg.	
	-2	Seal Oil Pressure	"	"	1320B	0-300	Alloy Steel	no	
	C- /PU-7	Calibration and Recovered							
	-1	VCL Pump	76-ALG-1905	Ashcroft	1320S	0-400	s.s.	no	
	E- /PU-1 thru 4								
	-1	Blend Tank Pump	76-ALG-1298	Ashcroft	1320A	0-100	Brass	150# flg.	
	E- /TK-1 thru 6	Blend Tank Agitator							
	-1	Purge Water	"	"	1320S	0-30	s.s.	no	
	C- /TK-25, -26, -27	Calibration and							
	-1	Short Stop Tanks	76-ALG-1905	Ashcroft	1320S	0-400	s.s.	no	
	C- /TK-25	Recovered VCL Filters							
	-2, -3		77-ALG-222	Ashcroft	1320AC	30"-0-150	s.s.	M&G AA	
	G- /CM-1	Fluidizing Compressor							
	-1	Silos	76-ALG-1905	Ashcroft	1320A	0-15	Bronze	no	
	H- /CM-1, -2	Fluidizing Compressor							
	-1	Silos	"	"	"	"	"	"	
	F- /FIL-1 thru 4, -7, -8								
	-1	VCL Filters	76-ALG-2532	Ashcroft	1320B	0-60	steel	1/2" NPT M&G AB	
	F- /FIL-5,-6,-9,-10								
	-1	VCL Filters	"	"	1320B	0-160	steel	1/2" NPT M&G AB	

PI	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Matl.	Seal	(All 4½" Dial, Accuracy 1/2 of 1%, 1/2" NPT bottom connection, blow-out disc micrometer adjustment)
	F- /CM-1, -3								
	-1	VCL Recovery Inlet	76-ALG-2532	Ashcroft	1320B	30"-0-60	steel	no	
	-2	Recovery InterStage	"	"	"	"	"	"	
	F- /CM-9								
	-1	Hi Pressure Recovery	"	"	"	0-100	"	"	
	F- /CN-3								
	-1	Hi Pressure VCL Recovery Cond.	76-ALG-1905	Ashcroft	1188P	0 - 5 psig			1/4" bottom connection
	F- /PU-1,-2,-3,-7								
	-1	Recovered VCL & Seal Pumps	76-ALG-2532	Ashcroft	1320B	0-300 psig	steel	1/2" NPT	
	F- /PU-4								
	-1	Seal Water Pump-out	76-ALG-2532	Ashcroft	1320B	0-30 psig	steel	no	
	F- /PU-5, -6								
	-1	Recovered Refrigerated Water Pump	"	"	"	0-100 psig	steel	no	
	F- /TK-1,-2,-7								
	-1	Recovered VCL & Surge Tanks	"	"	"	0-160 psig	steel	1/2" NPT	
	F- /TK-3,-6								
	-1	Seal Water	"	"	"	30"-0-60	steel	no	
	F- /TK-7								
	-2	Surge Tank Rupture Disc.	76-ALG-3062	Ashcroft	1000	0-30 psig	2½" Gauge with 1/4" NPT bottom		
	S-1, -	Fuel Oil Pump	76-ALG-1905	Ashcroft	1320B	0-160 psig	steel	no	
	S-2	Natural Gas Header	"	"	"	0-60 psig	steel	no	
	S-3,-4,-5,-8	Lo Pressure Steam Pump	76-ALG-2764	Ashcroft	1320B	0-60 psig	steel	no	
	S-6,-7	" " "	"	"	1320A	0-100 psig	Brass	no	
	U-1	Panel Factory Air	76-ALG-1433	Ashcroft	1377A	0-160 psig		no	
	U-2	Panel Instrument Air	"	"	"	0-60 psig		no	
	U-3	Panel Cooling Water	"	"	1377A-XPR	0-160 psig		no	
	U-4	Panel Steam Pressure	"	"	"	0-300 psig		no	
	U-5, -6		76-ALG-2764	"	1320A	0-200 psig	Brass	no	
	U- /CM-1								
	-1	Air Compressor Boiler House	76-ALG-1905	"	1320A	0-160 psig	bronze	no	
	U- /DR-1	Instrument Air							
	-1	Boiler House	"	"	1320A	0-60 psig	bronze	no	
	U- /PU-3, -4								
	-1	Cooling Tower Pump	76-ALG-1905	Ashcroft	1320A	0-160 psig	bronze element	M&G A	diaphragm s.s.
	U- /PU-5								
	-1	Steam to PU-5U	"	"	1320A	0-300 psig	brass element	M&G A	diaphragm s.s.
	U- /PU-5	Turbine Driven							
	-2	Cooling Tower Pump	"	"	1320A	0-60 psig	bronze element	M&G A	diaphragm s.s.
	-3	" "	"	"	1320A	0-160 psig	"	M&G A	"
	W- 1	Chlorine Cylinder	76-ALG-1905	Ashcroft	1320B	0-300 psig	steel element	M&G A	diaphragm tantalum
	W- /PU-5,-6								
	-1	Clarified Water Pumps	"	"	1320A	0-160 psig	brass element	no	
	X- /PU-1,-2								
	-1	D-M DeGasifier Pumps	76-ALG-1905	Ashcroft	1320S	0-60 psig	316 s.s.	no	
	Purge Air - (3) Drier Panels		76-ALG-1433	Ashcroft	1377A	0-30 psig		no	

PIM	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Scale	Reading	Fluid
	D- 1 thru 4	Poly Bldg.	106-ALG-728	Meriam Instr.	30EB25	0-40" w.c.			
	G- 1	"G" Dryers	106-ALG-908	Meriam Instr.	30EB25FF	25-0-25 w.c.			Sp.Gr. 1.0
	G- 2		"	"	40GE4	-1 to 0 to -3 w.c.			Sp.Gr. 0.827
	G- 3		106-ALG-728	Meriam Instr.	10AA-25	0 to 10" w.c.			
	G-4		106-ALG-728	"	10AA-25	0 to 30" w.c.			
	H-1, -2	"H" Dryers	106-ALG-908	Meriam Instr.	30EB25FF	25-0-25" w.c.			Sp.Gr. 1.0
	H-3, -4		"	"	40GE4	Plus 1 to 0 to -3			Sp.Gr. 0.827
	H-5,-6,-7,-8		106-ALG-728	Meriam Instr.	10AA-25	0 to 10" w.c.			

PR	F.S. Tag	Location	P.O.	Mfg.	Model	Chart	Signal	
	D- /PLY-1 thru 16	Poly Panel	66-ALG-206	Foxboro	5410	30" Hg-0-300 psi uniform		

PT	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Matl.	Seal	
	C- /PU-5 -1	Hi Pressure Cleaning Pump	96-ALG-959	Ohio Valve	TP110-A3-6"	0 - 7500 psig	Aluminum		
	D- /PLY-1 thru 16 -1	Poly Panel	66-ALG-158	Ashcroft	1260-AC	30" Hg-0-300 psig	s.s.	M&G C 1"-300#	
	F- 1		"	"	1260-A	0-100 psig		no	
	F- /CM-1, -3 -1, -2	Recovery Compressors	66-ALG-326	Foxboro	11GM	30" Hg-0-30" psig	s.s.		
	F- /CN-1 -1	Recovered VCL To Condenser	66-ALG-374	Foxboro	11GM	30" Hg-0-30" psig	carbon st. body, s.s. element		
	F- /CN-3 -1	Vent Gas	66-ALG-326	Foxboro	11GM	0-100 psig	s.s.		
	U- /1, -	Cooling Water Pressure	66-ALG-158	Ashcroft	1260-A	0-150 psig			
	U- /2	Steam Pressure	66-ALG-158	Ashcroft	1260-A	0-300 psig			

R	F.S. Tag	Location	P.O.	Mfg.	Model	Input	Output
	C- /MV-3,-4 -1	Poly Panel	76-ALG-2593	Fisher Governor	546	1 - 5 MA into 2500 phms, d.c.	output 3 to 15 psig
	D- /PLY-1 thru 16 -1	Poly Panel	106-ALG-408	Moore Pdts.	58H #3189-15	High Limit relay with setpoint gauge	
	F- /CN-1 -1	Recovered VCL Gas	66-ALG-393	Foxboro		3-15 psig	3-15 psig (base cond. for flow 14.7 psig)

STN	F.S. Tag	Location	P.O.	Mfg.
	C- /MV-1,-2 -1	with MV-1C,-2C	96-ALG-1135	Blott-Robb

SWF	F.S. Tag	Location	P.O.	Mfg.	Model	Type	Range	Differential
	F- /CM-1, -3 -1	Recovery Compressors	96-ALG-1441	McDonnell		FS7-SE	4 GPM for no flow	

SWL	C- /TK-20 -1	Seal Water Tank	96-ALG-776	United Elec.	142	J-96	0 - 18 psig	7 ∱ or - 1½" w.c.
	F- /CM-2,-4 -1	Recovery Comp. Separators	66-ALG-350	Instruments, Inc.	B-07	HL/LLFS with B-04-08 probe	150 psig max.	25 psig normal
	U- /WCT-1 -1	Cooling Tower Sump	96-ALG-1381	B.W.Controller		2-relay, 8'0" lg. electrode, Type E-1 electrode holder, 1" NPT bottom conn., 1/2" conduit conn.		

SWP	F.S. Tag	Location	P.O.	Mfg.	Type	Model	Range	Differential
	C- /PU-5C							
	-1,-2	Hi Pressure	96-ALG-776	United Electric	J-95	252	0-10 psi	1 plus or minus 1/4 psi
	-3	Lance Control	96-ALG-1566	R.G.Davis Co.	DAR-21		500 to 5000 psig	450 psi minimum
	C- /TK-19 and 25							
	-1, -2	Weighing System Recovered VCL	96-ALG-1572	United Electric	J99K	232	0-25 psi	
	C- /TK-21							
	-1	Seal Water Control	96-ALG-776	United Electric	J-95	362	0-350 psig	6 ≠ or - 2 psi
	C- /TK-22							
	-1	Nitrogen Surge Tank	96-ALG-1180	United Electric	J-95	364	0-500 psi	10#
	F- /CM-1, -3	Recovery Compressors						
	-1		96-ALG-1468	R.G.Davis		DAR-541	30" Hg 0-75 psig	6 psig min. circuit close on rising pressure
	-2		"	"		"	"	" circuit open on rising pressure
	-3		"	"		"	"	" circuit close on rising pressure
	F- /CM-2, -4	Recovery Compressors						
	-1		96-ALG-1477	United Electric	J-95	356	0-100 psig	2 ≠ or 1 1/2 psi
SWT	D- /PLY-1 thru 16							
	-1	Poly Panel	96-ALG-776	United Electric	J-21K	140	0-6 psi	4 ≠ or - 2 oz.
	F- /CM-1,-2,-3,-4							
	-1	Recovery Compressors	96-ALG-1477	United Electric	C-95	102	0-225°F	3 ≠ or - 1°F
	F-/CN-1							
	-1	Recovery Condensers	106-ALG-1112	United Electric	110	144	0-20 psig	

TA	F.S. Tag	Location	P.O.	Mfg.	Type	Model	Stock #	Range Diff.	Bellows Matl.
	C- /RF-1,-2								
	-1, -2	Catalyst Storage Box	96-ALG-1179	United Electric	J-6	142	9508	0-18 psi, 5½" w.c.	Brass
	D- / PLY-1 thru 16								
	-1	Poly Panel	96-ALG-776	United Electric	J21K	140		0-6 psi 3 or 4" w.c. ≠ - 1" w.c.	Brass
	F- /RF-1								
	-1	Recovery Chilled Water Unit	96-ALG-1902	United Electric	J110	144	9607	0-20 psig 7" ≠ - 1½" w.c.	
	G- /DR-1, -2								
	-1	"G" Dryer Alarm	96-ALG-776	United Electric	J21K	140		0-6 psi 3 or 4" w.c. ≠ - 1" w.c.	Brass
	H- /DR-1, -2,-3,-4								
	-1	"H" Dryer Alarm	96-ALG-776	United Electric	J21K	140		0-6 psi 3 or 4" w.c. ≠ - 1" w.c.	Brass
	U-1	Poly Panel	96-ALG-1179	United Electric	J-6	142	9508	0-18 psi 5½" w.c.	Brass
	U- /CM-1	Factory Air Compressor							
	-1		96-ALG-1657	United Electric	C-95	108	9189	200 - 425°F	

TB	F.S. Tag	Location	P.O.	Mfg.	Description
	D- /PLY-1 thru 16				
	-1	Polys	106-ALG-765	Research Instruments	Iron Constantan, s.s. sheath, 18" long plus head

TCI	Tag	Location	P.O.	Mfg.	Model	Range	Control	Action
	C- /HE-1	D-M Water Heater						
	-1	on V-D-1/HE-1C	76-ALG-1502	Fisher-Governor		0-200°F		
	C- /PU-1	D-M Hot Water Blending						
	-1	System	67-ALG-49	Foxboro	43A-A4F	40 - 240 uniform dial, 3 - 15 psig element		, direct action
	C- /TK-1 thru 6	Emulsifier Tank						
	-1	on V-D's	76-ALG-1502	Fisher Governor		0 - 300°F		
	C- /TK-10 thru 12	Buffer Makeup Tank						

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TCI	F.S. Tag	Location	P.O.	Mfg.	Model	Range	Control	Action
	C- /TK-20 -1	D-M Water Tank on V-D-1/TK-20C	76-ALG-1502	Fisher Governor		0 - 200°F		
	F- /CN-1 -1	Recovery Condenser on V-D-1/CN-1F	76-ALG-2267	"		450 GPM cold water at delta pressure of 3 psi		
	F- /CN-3 -1	Recovery Condenser on V-D-3/CN-3F	76-ALG-2724	"		0 - 100°F		
	F- /HE-1 -1	Seal Water Cooler on V-D-1/HE-1F	76-ALG-2267	"		30 - 130° F		
	S- /1	on V-D-5S	76-ALG-2594	"		0 - 150° F		
	X- /TK-1 -1	Clarified Water Storage Tank	47-ALG-125	U.S.Cauge		0 - 100° F		
	D- /TK-1 thru 6 BlowDown Tanks -1	on V-D-1/TK-1 thru 6D	76-ALG-1223	Fisher Governor		0 - 200° F		
	G- /HE-4 -1	First Stage Coil Protection Dryers	106-ALG-822	Lester Johnson (U.S.Gage)		0 - 100°F	Proportional	Direct
	G- /HE-5 -1	Silo Blower on V-D-1/HE-5G	76-ALG-1223	Fisher Governor				
	H- /HE-9, -10 -1	Silo Blower on V-D-1/HE-9,-10H	76-ALG-1223	Fisher Governor				

TCR	F.S. Tag	Location	P.O.	Mfg.	Model	Chart	Scale
	F- /HE-2 -1	High Pressure Vent Condenser	66-ALG-393	Foxboro	5412TS/58P4	0 - 100 proportional plus reset control	

TCRA/TCR	F.S. Tag	Location	P.O.	Mfg.	Model	Chart	Scale
	D- /PLY-1 thru 16 -1	Poly Panel	66-ALG-206	Foxboro	5422PS-F-PSB-1/58P5-B	75 - 175°F	50 to 250 uniform

Rack Mounted Controllers 58P4W
Sub Panels for 0- 20 psig air output

TCRA/TR	G- /DR-1 -1	"G" Dryer Panel	66-ALG-206	Foxboro	5422TS/58P4	control chart 50 - 200 unif.; recorder range 250 to 400 unif. .(red) Outlet Temp. chart x 1 = °F .(gr) Inlet Temp. chart + 200 = °F
	G- /DR-2 -1	"G" Dryer Panel	66-ALG-206	Foxboro	5422TS/58P4	control pen range 100 to 200 unif; recorder pen range 150 to 350 unif. .(red) Outlet Temp. Chart x 1 = °F .(gr) Inlet Temp. Chart x 2 - 50 equal °F
	H- /DR-1, -2 -1	"H" Dryer Panel	66-ALG-206	Foxboro	5422TS/58P4	control pen range 50 - 200 unif.; recorder range 250 to 400 unif. .(red Outlet Temp. chart x 1 equal °F .(Gr.) Inlet Temp. chart plus 200 equal °F
	H- /DR-3, -4 -1	"H" Dryer Panel	66-ALG-206	Foxboro	5422TX/58P4	control pen range 100 to 200 unif; recorder pen range 150 to 350 unif. .(red) Outlet Temp. chart x 1 equal °F .(gr) Inlet Temp. chart x 2 - 50 equal °F

TI	F.S. Tag	Location	P.O.	Mfg.	Range	Length	Well	Except as noted (All TI's are 5" bi-metallic with adjustable head, accuracy 1% with 1/4" stem of s.s. with 1/2" NPT. Ashcroft 50-6060 EHT wells are 304 s.s.
	D- 1	Poly Panel	66-ALG-239	Honeywell Model 15618836-38-01-1-000-061 Input: Iron Constantan Thermocouple Scale: 28 5/8" long Switches: Pushbutton Type mounted in door (48) Balance Speed: 4 ½ seconds	0 - 300°F			
	D- /PIY-16 -1 thru -4	Cooling Water	76-ALG-2533	Ashcroft	0 - 200° F	4"	3/4" NPT	
	F- /CM-1 thru 4 -1	VCL Recovery Compressors	76-ALG-2533	Ashcroft	0 - 200°F	4"	3/4" NPT	
	F- /CM-1 and 3 -2	"	"	"	0 - 200° F	4"	3/4" NPT	
	F- /CN-1 -1	Recovered VCL Condensers	"	"	-20 to 120° F	6"	3/4" NPT/lagging ext.	
	F- /CN-3 -1	" "	76-ALG-2840	"	-20 to 120°F	4"	3/4" NPT	
	F- /HE-1 -1	Recovered VCL Seal Water	76-ALG-2533	"	0 - 200°F	4"	3/4" NPT	
	F- /HE-2 -1	Recovered VCL	76-ALG-2840	"	-20 to 120° F	6"	3/4" NPT	
	F- /TK-1, -2 -1	Recovered VCL Storage	76-ALG-2533	"	0 - 200° F	12"	1" - 150# Flg. lagging ext.	
	F- /TK-3 -1		"	"	0 - 200°F	12"	1" NPT	
	G- /SCR-1,-2 -1	"G" Dryer Screener	76-ALG-2840	"	50 - 300°F	6"	3/4" NPT lagging extension	
	G- /BL-3 -1	"G" Dryer Exhaust Blower	76-ALG-1932	"	0 - 200° F	9"	none	
	G- /CE-1 -1	"G" Dryer Slurry Feed	"	"	0 - 250° F	4"	none	
	G- /DR-1,-2 -1	"G" Dryer Inlet and Outlet 1st stage and 2nd stage	"	"	50 - 400° F	9"	none	
	-2		"	"	0 - 200 ° F	9"	none	
	G- /SE-2, -3 -1	"G" Dryer 1st stand and second stage powder	"	"	0 - 200° F	9"	none	
	G- /TK-1, -2 -1	"G" Dryer Silos	76-ALG-2533	"	0 - 200°F	12"	none	
	H- /BL-5, -6 -1	"H" Dryer Outlet Temp.	76-ALG-1932	"	0 - 200° F	9"	none	
	H- /CE-1, -2 -1	"H" Dryer Slurry Feed Temp.	"	"	0 - 250°F	4"	none	
	H- /DR-1 thru 4 -1	"H" Dryer 1st and 2nd stage inlet temp.	76-ALG-1932	"	50 - 400° F	9"	none	
	H- /DR-1, -2 -2	"H" Dryer 1st stage outlet temp.	"	"	0 - 200° F	9"	none	
	H- /HE-1,-2 -1	"H" Dryer 1st stage temp.coils	"	"	0 - 200° F	9"	none	
	H- /SCR-1 thru 4 -1	"H" Dryer Screener	76-ALG-2533	"	50 - 400° F	6"	3/4" NPT/lagging	
	H- /SE-3,-4,-5,-6 -1	"H" Dryer 1st and 2nd stage Outlet Temp.	76-ALG-1932	"	0 - 200° F	9"	none	

TI

F.S. Tag	Location	P.O.	Mfg.	Range	Length	Well
H- /TK-1 thru 4 -1	"H" Dryer Silos	76-ALG-1932	Ashcroft	0 - 200° F	9"	none
S- 1	Fuel Oil	76-ALG-1932	"	0 - 200°F	9"	1" - 150# flange
U- 1	PanelBoard, Cooling Water	76-ALG-1433	Ashcroft 1377A-XPR- 4½"	0 - 100 psig		
U- 2,-3,-4	Cooling Water Temp.Cooling Tower	76-ALG-2840	Ashcroft	30 - 130°F	4"	3/4" NPT
U- /CM-1 -1, -2, -3	Factory Air Compressors	76-ALG-1932	Ashcroft	0 - 250° F	2½"	3/4" NPT
U- /WCT - -1	Cooling Tower Return	76-ALG-1932	Ashcroft	0 - 200°F	4"	3/4" NPT

Except as noted All TI's are 5" bi-metallic with adjustable head, accuracy 1% with 1/4" stem of s.s. with 1/2" NPT. Ashcroft 50-6000 AHT or EHT. Wells are 304 s.s.

TOR-CRA

F.S. Tag	Location	P.O.	Mfg.
G- /CE-1 -1	"G" Dryer Centrifuge Load	66-ALC-172	Foxboro
H- /CE-1, -2 -1	"H" Dryer Centrifuge Load	"	"

Torque Recorder Controller
Chart: 12" round, 1 rev/24 hrs.
Control: Proportional and reset
Alarms: 2 - both for power circuit and to be independently adj. and for use as high alarm and/or shutdown
Range; TOR-CRA-1/CE-1G 0 - 2500 unif.
TOR-CRA-1/CE-1H and 2H 0 - 1500 unif.

TOR-T

G- /CE-1 -1	"G" Dryer Centrifuge Load	66-ALC-172	Foxboro
H- /CE-1, -2 -1	"H" Dryer Centrifuge Load	"	"

Load Beams to work with above recorder controllers
Capacity: 50-100-150 lbs.

TR

F.S. Tag	Location	P.O.	Mfg.	Type	Chart	Pens	
D- /TK-1 and 4 -1	BlowDown Tank Temp.	66-ALG-278	Foxboro	5430 Consotrol	0 - 200	3	T-R-1/TK-1D .(red) Blowdown Tank #1 .(gr) Blowdown Tank #2 .(pur) Blowdown Tank #3 T-R-1/TK-4D .(red) Blowdown Tank #4 .(gr) Blowdown Tank #5 .(put) Blowdown Tank #6
C- /Cold Box -1	Catalyst Freezer Temp.	66-ALG-206	Foxboro	5420F	25-0-135 unif	2	.(red) chart x 1 equal °F .(gr.) chart x 1 equal °F
F- /1	Poly PanelBoard	66-ALG-393	Foxboro	5430	0-100 unif.	3	.(red) chilled water temp. .(gr) recovery exit temp. .(blue) vent exit temp.

TT

F.S. Tag	Location	P.O.	Mfg.	Range	Well Length
C- /Cold Box -1 ,-2	Catalyst Freezer	96-ALG-1374	Ashcroft	-25-0-135° F	6"
C- /PU-1, -2 -1	D-M Water Temperature	87-ALG-120	Ashcroft Type C7010H	40 to 240° F	6"

TI

F.S. Tag	Location	P.O.	Mfg.	Range	Well Length	Bulb
D- /PLY-1 thru 16						
-1	Poly Temperature	66-ALC-154	Moore Pdts	75 to 175° F		s.s. plain type
-2		"	"	50 - 250° F		s.s. 14' averaging
D- /TK-1 thru 6						
-1	BlowDown Tank Temperature	"	"	0 - 200° F	yes	
F- /CN-1	Recovered VCL					
-2		146-ALC-589	Moore Pdts	0 - 100°F	Socket: #12170-5L2	5½" long x 2 1/8" lagging with 1" NPT connection.
F- /CN-3			330-5072 with 1551-30	compression fittings	and socket mounting bracket #859-89	
-1		"	"	"	"	"
F- /HE-1						
-1	Recovered VCL Seal Water	"	"	"	"	"
F- /RF-1						
-1	Chilled Water	"	"	"	"	"
G- /DR-1						
-1	"G" Dryer inlet and outlet	66-ALC-154	Moore Pdts	50 - 200° F	no	std. rigid
-2	first stage	"	"	250 - 400° F	no	std. rigid
G- /DR-2						
-1	"G" Dryer inlet and outlet	"	"	100 - 200°F	no	std. rigid
-2	second stage	"	"	150 - 350°F	no	std. rigid
H- /DR-1, -2						
-1	"H" dryer inlet and outlet	"	"	50 - 200°F	no	std. rigid
-2	first stage	"	"	250 - 400°F	no	std. rigid
H- /DR-3, -4						
-1	"H" Dryer inlet and outlet	"	"	100 - 200°F	no	std. rigid
-2	second stage	"	"	150 - 350°F	no	std. rigid
H- /HE-1, -2						
-1	Tempering coils outlet temp.	"	"	0 - 200° F	no	std. rigid

TW

F.S. Tag	Location	P.O.	Mfg.	Length	Matl.
D- /PLY-1 thru 16					
-1	Polys	106-ALG-517	Research Instrument	14"	316 s.s., flange, carbon steel Bore "A" dimension 3/8" (BFG Std. 1318.1)

VD

F.S. Tag	Location	P.O.(Fisher-Governor)	Controller	Model	Size	Action with Air	Max.Inlet Pressure	Max. P	Positioner	Positioner Action		Solenoid
B-1 /8	Tank Farm VCL Charge Pump (Used as V-PA-35-1)	76-ALG-2593	P-CI-6B-1	4160R-657AR	1½"	open	200 psig		yes	3/15 in	3/15 out	
C-/ HE-1												
-1	D-M Water Heater Steam	76-ALG-1502	T-CI-1/HE-1C	657AR	2"	open	180 psig		yes	3/15	3/15	
-2	D-M Water Storage Tank	"	L-CI-1/TK-20C	9110	2"	open	60 psig		yes	3/15	3/15	V-S-1/HE-1C
C- /MV-1												
-1	VCL Charge Back Pressure	76-ALG-1502	P-CI-1/MV-1C	657AR	3"	open	200 psig		yes	3/15	3/15	V-S-1/MV-1C
C- /MV-2												
-1	VCL Charge Back Pressure	"	P-CI-1/MV-2C	657AR	3"	open	200 psig		yes	3/15	3/15	V-S-1/MV-2C
C- /MV-3												
-1	D-M Water Charge Flow Control	76-ALG-2435	F-CI-1/MV-3C (V-PA-1/MV-3C)	667Z	3"	open	200 psig		yes	3/15	3/15	V-S-1 & -2/MV-3C
C- /MV-4												
-1	D-M Water Charge Flow Control	76-ALG-2435	F-CI-1/MV-4C (V-PA-1/MV-4C)	667Z	3"	open	200 psig		yes	3/15	3/15	V-S-1 & 2/MV-4C

VD	F.S. Tag	Location	P.O. (Fisher-Governor)	Controller	Model	Size	Action with Air	Max. Inlet Pressure	Positioner	Positioner Action		Solenoid
C- /PU-1												
	-1	D-M Water Blending	77-ALG-270			1½"	close	120 psig	yes	3/15 in	3/15 out	
C- /PU-5												
	-1	Temp.Control Hi Pressure Clng.	76-ALG-2008		657DA	1"	close	6000 psig	yes	3/15	3/15	V-S-1/PU-5C
	-2	Hi Pressure Lance Control	"		667D	1"	open	6000 psig				V-S-2/PU-5C
	-3	" " " "	"		667D	1"	open	6000 psig				V-S-3/PU-5C
C- /PU-6, -7												
	-1	Recovered VCL Charging	76-ALG-2593	P-CI-1/PU-6 & 7C	416QR-6672	2"	open	250 psig	yes	3/15	3/15	
C- /TK-1 thru 6												
	-1	Emulsifier Tank	76-ALG-1502	T-CI-1/TK-1-6C	657AR	1½"	open	30 psig				
C- /TK-7 thru 9												
	-1	Emulsifier Charge	"		667Z	1"	open	15 psig				V-S-1/TK-7 thru 9C
C-/TK-10 thru 12												
	-1	Buffer Makeup Tanks	"	T-CI-1/TK-10-12C	657AR	1½"	open	30 psig				
C- /TK-13 thru 15												
	-1	Buffer Charge Bottle Inlet	"		667Z	1"	open	15 psig				V-S-1/TK-13 thru 15C
C- /TK-7 thru 9			"		667Z	1"	open	230 psig				V-S-2/TK-7 thru 9C
	-2	Emulsifier Charge Bottle Empty										
C- /TK-13 thru 15												
	-2	Buffer Charge Bottle Outler	"		667Z	1"	open	230 psig				V-S-2/TK-13 thru 15C
C- /TK-20C												
	-1	D-M Water Storage Tank Heating	"	T-CI-1/TK-20C	657AR	1"	open	200 psig				
C- /TK-21C												
	-1	Seal Water Control	"		657Z	1"	close	300 psig				V-S-1/TK-21C
	-2	" " "	"	P-CI-1/TK-21C	657Z	1"	close	300 psig				
C- /TK-19 and 25												
	-1	Recovered VCL and Calibration	76-ALG-2435		667Z	2"	open	100 psig				V-S-1/TK-19 and 25C
	-2	" " "	"		667Z	2"	open	250 psig				V-S-2/TK-19 and 25C
D- /PLY-1 thru 15												
	-1	Poly Cooling Water	76-ALG-1223			3"	close	130 psig	yes	3/9 in	3/15 out	
	-2	Poly Steam	"		657AR	1½"	open	220 psig	yes	9/15	3/15	
D- /PLY-16												
	-1	Poly Cooling Water	"			4"	close	130 psig	yes	3/9	3/15	
	-2	Poly Steam	"		657AR	1½"	open	220 psig	yes	9/15	3/15	
D- /TK-1 thru 6												
	-1	BlowDown Tank Heating	76-ALG-1223	T-CI-1/TK-1-6D	667A	1"	open	220 psig	yes	3/15	3/15	
D- /TK-7												
	-1	Head Cooling Water Return Tank	76-ALG-1698		9110	3"	open	18 psig	yes	3/15	3/15	
F- /CM-2		Inter-										
	-1	Recovered VCL Compressor Stage	76-ALG-2267		657AR	1½"	open	25 psig	yes	3/15	3/15	
	-2	Recovered VCL Seal Water Drain	"		667Z	1½"	open	25 psig	yes	3/15	3/15	
F- /CM-4F												
	-1	Recovered VCL Comp.InterStage	"		657AR	1½"	open	25 psig	yes	3/15	3/15	
	-2	Recovered VCL Seal Water Drain	"		667Z	1½"	open	25 psig	yes	3/15	3/15	
F- /CM-9												
	-1	Hi Pressure VCL Compressor Drain	"		667A	3/4"	open	100 psig				
	-2	Hi Pressure VCL Compressor Inlet	76-ALG-2724		667Z	3/4"	open	120 psig				
F- /CN-1												
	-1	Recovered VCL Condenser Water	76-ALG-2267	T-CI-1/CN-1F		4"		50 psig	3 psi	yes	3/15	3/15
	-2	Recovered VCL Control	76-ALG-2264			6"	open	120 psig		yes	3/15	6/30
F- /CN-3												
	-1	Vent Gas	76-ALG-2267		667A	1"	open	85 psig		yes	3/15	3/15
	-2	Recovered VCL Condenser	76-ALG-2267			1"	open	85 psig				
	-3	Cooling to Recovered VCL Condenser	77-ALG-443 s.s. body only 76-ALG-2724	T-CI-1/CN-3F	657A	1/2"	close	35 psig				

VD	F.S. Tag	Location	P.O. (Fisher-Governor)	Controller	Model	Size	Action with Air	Max. Inlet Pressure	Positioner	Positioner Action		Solenoid
	F- /HE-1 -1	Recovered VCL Seal Water	76-ALG-2267	T-CI-1/HE-1F	657A	1½"	close	100 psig	yes	3/15 in	3/15 out	
	F- /HE-2 -1	Cooling Recovered VCl	76-ALG-2724			2"	close	35 psig	yes	3/15	3/15	
	F- /RF-1 -1	Recovered VCL Chilled Water	76-ALG-2734		9110	6"	open	35 psig	yes	3/15	3/15	
	F- /SE-5 -1	Separator Drain	76-ALG-2267		657AR	1½"	open	30 psig				
	F- /TK-3 -1	Seal Water Drain	76-ALG-2267		657A	2"	close	5 psig				
	F- /TK-6 -1	Seal Water Tank equalization	76-ALG-2267	P-CI-1/TK-6F	4162R-657A	1"	close	1 psig				
	-2	Seal Water Level	"		667A	1"	open	90 psig				
	G- /CE-1 -1	"G" Dryer Slurry Control	76-ALG-1223		V-Ball	2"	open	20 psig	yes	3/15	3/15	V-S-1/CE-1G
	G- /HE-1 -1	with Heat Exchanger										
	G- /HE-2 -1	"G" Dryer 2nd stage Temp.	76-ALG-1223			2"	open	180 psig	yes	3/15	3/15	
	G- /HE-4 -1	"G" Dryer Tempering Control	76-ALG-1223			1"	close	200 psig				
	-2	"G" Dryer 1st stage Temp.Control	"			1"	open	180 psig	yes	3/15	3/15	
	G- /HE-5 -1	Silo Temperature Control	"	T-CI-1/HE-5G		1"	close	180 psig				
	H- /CE-1, -2 -1	Slurry Feed Control H Dryers	"	T-CI-1/CE-1,-2H	V-Ball	2"	open	20 psig	yes	3/15	3/15	
	H- /HE-3, -4 -1	H Dryer 1st stage Temp.Control	76-ALG-2435		657AR	2"	open	220 psig	yes	3/15	3/15	
	H- /HE-7, -8 -1	"H" Dryer Tempering Control	76-ALG-1223			1½"	close	30 psig				
	-2	"H" Dryer 2nd stage Temp.Control	"			1"	close	180 psig	yes	3/15	3/15	
	H- /HE-9, -10 -1	Silo Temperature Control	"	T-CI-1/HE-9,-10H		1"	close	180 psig				
	S- 1	Natural Gas Control	76-ALG-1934	P-CI-1S		4"	open	60 psig	yes	3/15	3/15	
	S- 3	30 psi Steam Condensate	76-ALG-2594		657A	1½"	close	30 psig				
	S- 4	Low Pressure Steam Condensate	"			1½"		45 psig				
	S-5	Cooling Water Flash Condensate	"	T-CI-1S		1¼"	close	180 psig				
	U- 1 thru 6	Fog Nozzles	76-ALG-2435		512G	2"	close	150 psig				
	U- /DR-1 -1	Instrument Air Dryer "	76-ALG-1698	F-CI-1/DR-1U	657A	1½"	close	100 psig	yes	3/15	3/15	
	-2	"	"	P-CI-1/DR-1U	9110	4"	close	110 psig	yes	3/15	3/15	
	-3	"	"	P-CI-2/DR-1U	4160-657A	1½"	close	100 psig	yes	3/15	3/15	
	U- /PU-5 -1	Steam To Cooling Tower Turbine	76-ALG-1934			4"	open	200 psig				V-S-1/PU-5U
	U- /WCT-1 -1	Makeup Water Cooling Tower	76-ALG-1698		657A	1½"	close	40 psig	yes	3/15	3/15	

VD	F.S. Tag	Location	P.O. (Fisher-Governor)	Controller	Model	Size	Action with Air	Max. Inlet Pressure	Positioner	Positioner Action		Solenoid
	W- /TK-4 -1	Clarified Water Surge Tank	76-ALG-2435		9110	4"	open	60 psig	yes	3/15	3/15	
	W- /WS-1 -1, -2	Clarifier	76-ALG-1931 (Good Tech.)	Worcester 411B Ball		2" Bronze, screwed connections						35B flowmate actuator
	X- 1	DeMineralizers	76-ALG-1698	P-CI-1X	9110	3"	close	90 psig	yes	3/15	3/15	
	X- 2	"	"		9110	6"	close	20 psig				V-S-1/V-D-2X
	X- 3	"	"		9110	4"	close	14 psig	yes	3/15	3/15	
	X- 4	"	76-ALG-2267	P-CI-2X		2"	open	100 psig	yes	3/15	3/15	V-S-1/V-D-4X
	X- /TK-1 -1	DeMineralizer Controls	76-ALG-1698		9110	2"	close	40 psig	yes	3/15	3/15	
	-2	"	"		9110	2"	close	40 psig	yes	3/15	3/15	
	-3	"	"		9110	2"	close	40 psig	yes	3/15	3/15	
	-4	"	46-ALG-4027A		667A	1½"	open	200 psig	yes	3/15	6/30	(without gages & bypass)

VM	F.S. Tag	Location	P.O.	Mfg.	Model	Pressure	Nozzle	Construction
	D- PLY-1 thru 16 -1	Polys	106-ALG-446	Schutte & Koerting	217	3" suction & discharge NPT, 2" pressure NPT 200 psig steam pressure	Type 60	Bronze

VPA	F.S. Tag	Location	P.O.	Mfg.	Model	Size	Inlet Pressure	P Pres.	Flow	Action	Positioner
	C- 1	Nitrogen Reducer	76-ALG-1933	Fisher	630	1"	300 psig		12,000 SCFH		
	B-1 -3	use valve ordered as V-P-8B-1									
	C- /MV-3, -4 -1	on V-P-1/MV-3 & 4C	76-ALG-2435		67 FRTC						
	C- /PU-3, 4 -1	Poly Seal Pressure Control	76-ALG-2435	Fisher P-CI-1/PU-3,4C	4160-667Z	1"	380 psig		32 GPM	air to open	3/15 in 3/15 out
	C- /PU-5 -1, -2	Lance Control	76-ALG-2008	Fisher	67 FRTC		5 to 20 psi spring range		w/output gage		
	C- /TK-21 -1	Nitrogen Reducer Poly Seal Water	46-ALG-2264	Air Pdts.Distr.	Cylinder Regulator, Fluid Nitrogen - Linde, outlet pressure: 300 psig, output gage						
	C- /TK-19 and 25 -1, -2	Recovered VCL Charge Contr	146-ALG-577	Moore Pdts.	40-15	1/4" NPT	Input: 40 psig; Output 3 to 15 psig				
	F- /CM-1 -1	Recovered VCL Compressor Contr.	76-ALG-3033	Fisher-Governor	95H	1/2" NPT	Range: 15 to 30 psig; Service: To reduce 300 psig N2 to 20 psig.				

VS	F.S. Tag	Location	P.O.	Mfg.	Type
	C- /HE-1 -1	on V-D-2/HE-1C	76-ALG-1502	Fisher-Governor	3-way
	C- /MV-1, -2 -1	on V-D-1/MV-1,-2C	"	"	3-way

VS	F.S. Tag	Location	P.O.	Mfg.	Type	
	C- /MV-3, -4					
	-1	on V-D-1/MV-3,-4C	76-ALG-2435	Fisher-Governor	3-way	
	C- /PU-5					
	-1	on V-D-1/PU-5C	76-ALG-2008	"	3-way	
	-2	on V-D-2/PU-5C	"	"	3-way	
	-3	on V-D-3/PU-5C	"	"	3-way	
	C- /TK-7 to 9C					
	-1	on V-D-1/TK-7 - 9C	76-ALG-1502	"	3-way	
	-2	on V-D-2/TK-7 - 9C	"	"	3-way	
	-3	Emulsifier Charge Bottle Nit.	76-ALG-1434	ASCO 8302A25R	3-way	Fluid: Nitrogen; Inlet Pres: 300 psig; Drop: 300 psi max. Conn. 1/4" NPT
	C- /TK-13 to 15					
	-1	on V-D-1/TK-13 - 15C	76-ALG-1502	Fisher-Governor	3-way	
	-2	on V-D-2/TK-13 - 15C	76-ALG-1502	Fisher-Governor	3-way	
	-3	Buffer Charge Bottle Nitrogen	76-ALG-1434	ASCO 8302A25R	3-way	Fluid: Nitrogen; Inlet Pres: 300 psig; Drop: 300 psi max. Conn. 1/4" NPT
	C- /TK-21					
	-1	on V-D-1/TK-21C	76-ALG-1502	Fisher-Governor	3-way	
	-2	on V-D-2/TK-21C	"	"	3-way	
	C- /TK-19 & 25					
	-1	on V-D-1/TK-19 & 25C	76-ALG-2435	Fisher-Governor	3-way	
	-2	on V-D-2/TK-19 & 25C	76-ALG-2435	Fisher-Governor	3-way	
	F- /CM-1					
	-1,	Recovered VCL Compressor Control	76-ALG-2997	ASCO X8302B26RU	3-way Universal	Conn: 1/4" NPT scr.; Service: Gas - 3 to 50 psia at "C" connection 25 psig at "B" connection
	F- /CM-3					
	-1	Recovered VCL Compressor Control	76-ALG-2997	ASCO X8302B26RU	3-way Universal	Conn: 1/4" NPT scr.; Service: Gas - 3 to 50 psia at "C" connection 25 psig at "B" connection
	U- /PU-5					
	-1	on V-D-1/PU-5U	76-ALG-1934	Fisher-Governor	3-way	
	G- /CE-1					
	-1	on V-D-1/CE-1G	76-ALG-1223	Fisher-Governor	3-way	
	H- /CE-1,-2	on V-D-1/CE-1, -2H	76-ALG-1223	"	3-way	
	I- 2	on V-D-2X	76-ALG-1698	Fisher-Governor	3-way	
	I- 4	on V-D-4X	76-ALG-1698	"	3-way	

VSP	F.S. Tag	Location	P.O.	Mfg.	Model
	C- /PU-1				
	-1	D-M Water Temperature Control	67-ALG-49	Foxboro	38359 Two Position, Three Port Air Switch
	C- /PU-5				
	-1, thru -4	Hi-Pres. Lance Control	76-ALG-2008	Fisher-Governor	III Lock Shield Needle Valve with 1/4" NPT conn., brass construction.
	C- /TK-21				
	-1	Poly Seal Water Control	76-ALG-2903	ASCO 832010	3-way solenoid; NPT connection, 1/8" orifice; Oper. Pres. 20 psig,
	C- /TK-19 & 25				
	-1	Recovered VCL Charge Control	76-ALG-2542	Conant #38359T	3-way 90° turn plug valve with 1/4" NPT conn., brass body, teflon plug
	D- /PLY-1 thru 16				
	-1	Vacuum Test Polys	106-ALG-728	Meriam D-1295	Hose Nipples, s.s., conn: 1/4" NPT
	D- /PLY-16				
	-8,-9,-10	Cooling Water Poly 16	76-ALG-2547	Anderson Greenwood	Model M-8C, const: body, carbon steel, spindle & seat, 303 s.s. and/or 316 s.s., conn: 1/2" NPT

VSP	F.S. Tag	Location	P.O.	Mfg.	Model			
	D- /TK-1 thru 6							
	-1	BlowDown Tank Heating ShutOff	76-ALG-1880	Contromatics	Ball Valve with 250 BV Cylinder actuator and solenoid valve conn: 150#; matl: s.s. type 316; with teflon seal - Viton "O" Ring Fluid: steam; Pres. 130 psig. Air Pres: 80 psig.			
	F- /CM-1							
	-1	Recovered VCL Compressor	76-ALG-2335	Good Technical Serv.	Ball Valve	6"	energize to close	Upstream Press. 150 psig
	-2	Control	"	"	"	4"	open	25
	-3	"	"	"	"	2"	open	75
	-4	"	"	"	"	1"	open	75
	F- /CM-2							
	-1	"	"	"	"	1½"	close	25
	-2	"	"	"	"	2"	open	75
	-3	"	"	"	"	1"	open	75
	-4	"	"	"	"	1½"	close	75
	-5	"	"	"	"	1"	open	25
	F- /CM-3							
	-1	"	"	"	"	6"	close	150
	-2	"	"	"	"	4"	open	25
	-3	"	"	"	"	2"	open	75
	-4	"	"	"	"	1"	open	75
	F- /CM-4							
	-1	"	"	"	"	1½"	close	25
	-2	"	"	"	"	2"	open	75
	-3	"	"	"	"	1"	open	75
	-4	"	"	"	"	1½"	close	75
	-5	"	"	"	"	1"	open	25
	F- /CM-9							
	-1	"	"	"	"	1½"	open	80
	-2	"	"	"	"	2"	close	25
	F- /CN-1 & 3							
	-1	Recovered VCL & Vent Gas	76-ALG-2168	Anderson Greenwood Type M2XC, conn: 1/2" NPT				
	-2/CN-3F	Vent Gas Oxygen Analyser	76-ALG-2688	CONANT #38359T, 3-way, 3-port plug valve, body: Brass., conn: 1/4" NPT				
	F- /RF-1							
	-1	Chilled Water Flow	76-ALG-2708	Anderson Greenwood MIC-4 conn: 1/2" NPT				
	S- 1	New Boiler Steam	76-ALG-2842	Anderson Greenwood M8C, conn: 1/2" NPT				
	U- 1 thru 20	Fog System Poly Bldg.	146-ALG-582	Johnson Service Co. S-2001 Pneumatic PushButtons, Model P; Air supply: 35 psig				
	U- /DR-1							
	-1	Instrument Air Dryer	76-ALG-2842	Anderson Greenwood M8C conn: 1/2" NPT				
	W- /WS-1							
	-1	Clarifyer Water Flow	76-ALG-2547	Anderson Greenwood M8C conn: 1/2" NPT				

WCR	F.S. Tag	Location	P.O.	Mfg.	
	C- /TK-7 thru 9				
	-1	Emulsifier Charge	66-ALG-174	Foxboro	Dynalog Weight Recorder; Chart: 0 - 300 lbs., Automatic fill & empty; 2 Indexes; Max. Tare: 100#
	C- /TK-13 thru 15				
	-1	Buffer Charge	"	"	" " " "

WI	F.S. Tag	Location	P.O.	Mfg.	Model
	C- /TK-19 & 25				
	-1	Recovered VCL Charge	106-ALG-832	A.H.Emery Co.	16" indicator dial, 0 to 10,000 lbs. with an inner batching dial, Nylon Tubing Tare Weight 5,250#; Gross Weight 15,200 #
WR	C- /TK-19 & 25				
	-1	Recovered VCL Charge	66-ALG-264	Foxboro	5420F Chart: 0 - 400 Element: Red Pen 3 - 9 psig; Green Pen 9 - 15 psig
WT	C- /TK-19 & 25				
	-1	Recovered VCL Charge	106-ALG-832	A.H.Emery Co.	EU-20 Hydraulic Load Cell with threaded rod
	-2	" " "	"	"	11GM Pressure Transmitter to take output of load cell and convert it to a 3 - 15 psig air signal
	C- /TK-7 thru 9 Emulsifier Charge Bottle Weight TK-13 thru 15 Buffer Charge Bottle Weight				
	-1		66-ALG-174	Foxboro	Tension load cell, Rating 0 - 500 lbs. accuracy: ± - 0.1% temp compensated

Chemical Safety Data Sheet SD-56

PROPERTIES AND ESSENTIAL INFORMATION

FOR

SAFE HANDLING AND USE

OF

VINYL CHLORIDE

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ADOPTED 1954

Chemicals in any form can be safely stored, handled or used if the physical, chemical and hazardous properties are fully understood and the necessary precautions, including the use of proper safeguards and personal protective equipment, are observed.

MCA MANUFACTURING CHEMISTS ASSOCIATION

1825 CONNECTICUT AVENUE, N. W. WASHINGTON, D. C. 20009

CONFIDENTIAL

11

CHEMICAL SAFETY DATA SHEET

VINYL CHLORIDE

SUMMARY

Vinyl chloride is a highly volatile extremely FLAMMABLE compressed gas which is ordinarily handled in liquefied form under pressure. It has a mild anesthetic action in concentrations above 500 ppm. and its vapors are irritating to the eyes.

Precautions necessary in handling the material are detailed in the body of the Safety Data Sheet. Key points to consider for safe handling include:

1. Keep away from heat, sparks and open flame.
2. Provide adequate ventilation.
3. Ground equipment and containers before discharging to reduce danger of ignition from static sparks.
4. In discharging do not heat containers above 50°C. (122°F.). No heat should be applied to tank cars.
5. All equipment should be of steel and have a designed working pressure of at least 100-150 psi.
6. In the event of accidental leaks, spills or whenever excessive vapor concentrations may be encountered only personnel equipped with approved respiratory protection should be permitted in the contaminated area.
7. Chemical safety goggles should be worn when discharging containers or tank cars or whenever there is a danger of the liquid or saturated vapor coming in contact with the eyes.
8. Waste disposal should be away from any source of ignition. Dilute phenolic residues before discharging to sewer.

In case of fire use carbon dioxide or dry chemical extinguishing equipment. In the event of contact with the liquid remove contaminated clothing immediately. For eyes flush immediately with large quantities of water for at least 15 minutes while medical attention is being sought.

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Chemical Safety Data Sheet

VINYL CHLORIDE

Adopted February, 1954

1. NAME

Chemical Names: Vinyl Chloride
Chloroethylene
Chloroethene
Common Name: Vinyl Chloride
Formula: CH_2CHCl

2. PROPERTIES

2.1 Grade:

Technical with inhibitor. (Purity of sample 99.42%)

2.2 Important Physical and Chemical Properties:*

Boiling Point	—13.8°C. (+7°F.)
Color	Colorless or water white
Corrosivity	Noncorrosive at normal atmospheric temperatures when dry (moisture free). In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel.
Explosive Limits (Percent by Volume in Air)	Lower 4%; Upper 22%
Flash Point	—78°C. (—108.4°F.), Open-Cup
Hygroscopicity	No
Critical Pressure	52.7 Atmospheres
Critical Temperature	158.4°C. (317°F.)
Deliquescence	No
Ignition Temperature, Autogenous	472.22°C. (882°F.) (Vapors above —60°F.)
Light Sensitivity	Not a factor in handling inhibited vinyl chloride
Melting Point (Freezing Point)	—153.71°C. (—245°F.)
Molecular Weight	62.50
Odor	Sweet smelling gas
Physical State	Gas at ordinary temperature and pressure. Liquid under pressure in cylinders or pressure vessels at room temperature.
Reactivity	Polymerizes readily in presence of air, sunlight, oxygen or heat. This behavior is due to the presence of a double bond. Otherwise vinyl chloride is quite stable.
Specific Gravity	.9121 @ 20°/20°C. (Water = 1.00)
Vapor Density	2.15 (Air = 1.00)
Vapor Pressure	2580 mm. of mercury 20°C. (68°F.)

*Many of the data recorded under this paragraph were determined in the research laboratory of one of the large producers of vinyl chloride and are based on a technical grade material having a purity of 99.42%. Materials from other sources may vary in accordance with the nature of the impurities or the character of the inhibitor present.

2.3 Hazardous Properties

2.3.1 *HEALTH HAZARDS* (See 8. Health Hazards and Their Control)

Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

2.3.2 *FIRE HAZARD*

Vinyl chloride vapors form flammable mixtures with air at all temperatures above —78°C. (—108.4°F.)

3. USUAL SHIPPING CONTAINERS

3.1 Type and Size

3.1.1 Approved ICC cylinders and tank cars designed to carry liquid gases under pressure and equipped with safety relief devices.

3.1.2 All parts of valve and safety devices in contact with contents of containers must be of metal or other material, suitably treated if necessary, which will not cause formation of any acetylides. A good practice is to dismantle all valves for inspection before each loading. Approved cylinders include ICC-4B300, ICC-4BA300, ICC-3A300, and ICC-3AA300. *Cylinders with brazed seams are not permitted.*

3.1.3 Some types of tank cars are ICC-106A-500, ICC-106A500X, ICC-105A300 and ICC-105A300W. Maximum permitted filling density is 84% for cylinders and for Class ICC-106A cars and for Class ICC-105A cars 87%.

3.1.4 Filling density is defined as the per cent ratio of the weight of chemical in the tank to the weight of water that the tank or cylinder will hold.

3.1.5 ICC Regulations require that vinyl chloride must be inhibited for the purpose of transportation (See 6.2.3).

3.2 Label or Identification

3.2.1 Each container of vinyl chloride (including tank cars) should carry an identifying label or stencil.

3.2.2 The Manufacturing Chemists' Association recommends the following in addition to, or in combination with, any label warnings or other statements required by statutes, regulations, or ordinances:

VINYL CHLORIDE

DANGER! EXTREMELY FLAMMABLE LIQUID AND GAS UNDER PRESSURE

Keep away from heat, sparks, and open flame.

Keep container closed.

Use with adequate ventilation.

Avoid prolonged breathing of vapor.

3.2.3 Each shipping container must bear the ICC red label for FLAMMABLE compressed gases.

3.2.4 Tank cars and railroad cars carrying one or more containers of vinyl chloride must bear the ICC DANGEROUS placard.

3.3 Disposal and Return Precautions

3.3.1 Small containers (ICC-4B300 and ICC-4BA300, without brazed seams, ICC-3A300, ICC-3AA300) should be drained free of liquid vinyl chloride and the valves closed tightly before they are returned to the supplier. No air should be permitted to enter the container (See 4.3).

3.3.2 In addition, the following precautions must be taken:

3.3.2.1 *Return of Small Containers*

The cylinder valve protection cap or outlet cap must be securely replaced. The lower portion of the ICC shipping tag, if attached to the cylinder, must be removed. In other cases, applicable to ICC Regulations, compliance is essential. Bill of lading should give the cylinder identification number (which appears on the shoulder of cylinder) for each cylinder shipped, show name of consignee and indicate that the cylinders are empty (See 3.3.5).

Full or partly emptied cylinders should not be returned without permission of the supplier. Such cylinders must be shipped as full cylinders and correspondingly labeled and tagged (See 3.2). All empty cylinders should be returned promptly.

3.3.3 Tank cars (ICC-106A500, ICC-106A-500X, ICC-105A300, and ICC-105A300W) should be drained free of liquid vinyl chloride, the valves should be securely closed and the valve plugs replaced. No air should be permitted to enter the vessel. The inert gas used for the unloading procedures (See 4.4 Tank Cars) should be left in the vessel at a pressure not to exceed the service pressure for which the car is authorized.

3.3.4 In addition, the following precautions must be taken:

3.3.4.1 *Return of Tank Cars*

As soon as a tank car is completely unloaded, all valves must be made tight, the unloading connections must be removed and all closures made tight, except that heater coil inlet and outlet pipes (if any) must be left open for drainage. Heater coils must never be used in unloading vinyl chloride. Empty tank cars should be returned as promptly as possible, in accordance with instructions received from shipper.

3.3.5 Follow ICC Regulations regarding the replacement of closures, condition and labeling of empty containers; condition of empty cars and placard requirements before returning to shipper. The ICC DANGEROUS placards on sides and ends of tank cars must be removed, or reversed (if in metal placard holders) by the party discharging the tank car. The empty car must be offered to the receiving carrier either without placards, or preferably with four (4) DANGEROUS-EMPTY placards.

4. UNLOADING AND EMPTYING

4.1 Health Hazards (See 8. Health Hazards and Their Control)

4.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

4.2 Fire and Explosion Hazards

4.2.1 Vinyl chloride should always be handled with full recognition of its flammability. Precautions should be taken both to keep the material enclosed and to eliminate sources of ignition. Reliance must be placed upon the elimination of all sources of ignition and on the provision of sufficient ventilation to keep escaping vapors at nonflammable levels (See 6.2).

4.3 Cylinders

4.3.1 Precautions generally applied to use of cylinders (ICC-4B300 and ICC-4BA300, without brazed seams, ICC-3A300, ICC-3A-A300) for flammable liquefied gases should be used.

4.3.2 A water bath heated to a maximum of 50°C. (122°F.) may be used to empty cylinders by means of the vapor pressure of the vinyl chloride.

4.3.3 Check valves must be installed in feed lines from the cylinder to prevent the reactants from entering the cylinder.

4.3.4 When the cylinder is empty, the valve should be securely closed. Air should not be allowed to enter the container.

4.3.5 Valve protective caps should be kept in place on cylinders except when the cylinders are connected for discharge.

4.3.6 Cylinders must not be filled except by or with the consent of the owner, and then only in accordance with the Regulations of the Interstate Commerce Commission.

4.3.7 No attempt should ever be made to mix gases or liquids in a cylinder.

4.4 Tank Cars

4.4.1 Applicable instructions for unloading tank cars containing flammable liquids are set forth in MCA Manual Sheet TC-4. (Also see ICC Regulations, Sec. 74.560 to 74.563 inclusive, for unloading tank cars.)

4.4.2 Shipper's instructions should always be followed and all caution markings on both sides of tank and dome should be read and observed.

4.4.3 In the event of a tank car fitting failure or leak, the shipper should be telephoned or wired immediately for instructions (See 6.3).

4.4.4 Tank cars should be electrically grounded to dissipate static or induced lightning charges.

4.4.5 No heat should be applied to the tank car. An inert gas line or compressed vinyl chloride gas line should be attached to vent connection of the tank car to provide a pressure for transfer of the liquid vinyl chloride from tank car to receiving tank.

Cylinder nitrogen (inert gas) is often used as the pressuring medium in the event vinyl chloride gas is not available. Larger installations may have a suction line connected from the storage tank to a compressor which discharges compressed vinyl chloride gas to vent connection on tank car. The pressure on the car should never exceed the service pressure at which the safety valve is set to operate.

4.4.6 Some tank cars in vinyl chloride service are equipped with excess flow check valves. A too rapid opening of the discharge valves will cause the check valves to close. If this should occur, the outlet valve should be closed until the pressure is equalized and the excess flow valve opens.

4.4.7 Positive vinyl chloride or inert gas pressure should be left in car. No air should be allowed to enter car (See 3.3.3).

5. STORAGE

5.1 Hazards (See 8. Health Hazards and Their Control)

5.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

5.1.2 Vinyl chloride should always be handled with full recognition of its flammability. Precautions should be taken both to keep the material enclosed and to eliminate sources of ignition. If there should be any unavoidable leaks, reliance must be placed upon the elimination of all sources of ignition and on the provision of sufficient ventilation to keep escaping vapors at nonflammable levels (See 6.2).

5.1.3 *CORROSION*

Vinyl chloride is noncorrosive at normal atmospheric temperatures when dry (moisture free). In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel.

5.1.4 *VOLATILITY*

Vinyl chloride is very volatile and is a gas at normal atmospheric conditions. Containers used for handling vinyl chloride at atmospheric temperature are always under pressure.

5.1.5 *TEMPERATURE REQUIREMENTS*

Inhibited vinyl chloride may be stored at normal atmospheric conditions in suitable pressure vessel.

Uninhibited vinyl chloride may be stored either under refrigeration or at normal atmospheric temperature in the absence of air or sunlight but only for a duration of a few days. If for longer periods, regular checks should be made for the presence of polymers.

5.2 Conditions of Storage

5.2.1 *TYPE OF CONSTRUCTION*

All piping (including instrument leads), storage tanks, relief devices and equipment employed to handle vinyl chloride should be of steel and designed to have a working pressure of at least 100-150 psi with a safety factor conforming to the A.S.M.E. code for unfired pressure vessels or any code applying to locale of planned storage. Shut-off valves and control

valves should be of steel or a suitable alloy not bearing copper, designed for working pressures of 150 psi or over. All-welded construction is preferred to riveted construction. It is recommended wherever possible that all liquid inlet lines enter the bottom or extend to the bottom of the vessel. This guards against the accumulation of static electricity. All equipment should be properly grounded with resistance to ground never exceeding 25 ohms. An efficient water spray system should be installed or made available. Adequate diking and drainage should be provided under tank area to confine and dispose of the liquid in case of vessel rupture. Any cylinders used to store vinyl chloride must meet ICC Specifications.

5.2.2 *ISOLATION*

Storage areas should be selected in accordance with local codes or authorities having jurisdiction. (Assistance may be obtained from such organizations as National Board of Fire Underwriters, Factory Insurance Association, Associated Factory Mutual Fire Insurance Companies.) For highly volatile and flammable material, storage should be located outside of buildings. Cylinders containing vinyl chloride should be stored always in a vertical position, outside of buildings, and in an isolated and well ventilated area. It is preferable to store cylinders in the open, but provision should be made to shield them from the direct rays of the sun and prevent accumulation of dirt, snow, water, or ice on valves or safety devices.

5.2.3 *COMPATIBLE AND DANGEROUSLY REACTIVE MATERIALS*

Tanks in vinyl chloride service should be used only for the storage of vinyl chloride (See 6.8). Before vinyl chloride is placed in a tank, the vessel should be purged with an inert gas until free of air. Vinyl chloride is generally noncorrosive at normal atmospheric temperatures when dry (moisture free). However, mild to appreciable corrosion has been noted even at ordinary temperature. This may be due to the presence of impurities. In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel. Acetylene as an impurity in vinyl chloride may form an explosive compound (acetylide) when exposed to copper or possibly copper alloys.

5.2.4 *VAPOR-PROOF OR EXPLOSION-PROOF REQUIREMENTS*

All electrical equipment, motors, lights, and flashlights used in an area in which vinyl chloride is stored or handled should conform to the National Electrical Code (Class I, Division II for storage; and Class I, Division I for use).

5.2.5 *VENTING REQUIREMENTS*

An adequate system for normal and emergency venting should be installed. All vent lines should extend to a safe area free of any source of ignition. The point of outlet should be equipped with an approved flame arrestor. Relief valves should be installed in pairs, parallel, using transflow valving to facilitate periodic testing and repairing.

5.2.6 *VENTILATION*

All storage areas should be provided with continuous ventilation. Pits, depressions and basements should be avoided.

5.2.7 *PROTECTION FROM ELECTRICAL STORMS*

Storage tanks for vinyl chloride should be protected from electrical storms and induced static electricity by grounding of all equipment.

5.2.8 *PROTECTION FROM INTERNAL EXPLOSIVE MIXTURES*

Storage tanks and other vessels should be maintained under positive pressure utilizing an inert gas when necessary or vapor pressure of the vinyl chloride. Vessels should be provided with bottom inlets under the liquid, or dip pipe extending from the top of the vessel to within inches of the bottom of the vessel to protect against a static discharge.

6. HANDLING

6.1 **Health Hazards** (See 8. Health Hazards and Their Control)

6.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

6.2 **Fire, Explosion, and Polymerization Hazards**

6.2.1 *FIRE HAZARDS*

Vinyl chloride should always be handled with full recognition of its volatility and its flammability. In general, precautions should be taken both to keep the material enclosed and to eliminate all sources of ignition. In small

laboratory operations, where vinyl chloride vapors may escape, reliance must be placed upon the elimination of sources of ignition and the provision of sufficient ventilation to keep escaping vapors at non-flammable levels. Vinyl chloride vapors can form flammable mixtures with air at all temperatures above —78°C. (—108.4°F.).

Fires involving large quantities of liquid are difficult to extinguish since vinyl chloride is not miscible with water and is lighter than water (will float on top of water). Most small fires can be extinguished with carbon dioxide or dry chemical agents if properly applied. Adequate fire extinguishing equipment of carbon dioxide or dry chemical type, fixed and portable, should be provided. Water spray is also satisfactory for extinguishing fires. Diking and drainage should be provided for confining and disposing of the liquid in case of tank rupture or spills. Precautions should be taken to guard against vinyl chloride entering general sewer system (See 6.3).

In event of a fire no unauthorized person should be permitted to enter an unventilated area until the space has been thoroughly sprayed with water to remove gases such as hydrogen chloride, phosgene, carbon monoxide, etc. generated from the fire.

6.2.2 *EXPLOSION HAZARDS*

Vinyl chloride is a gas at normal atmospheric temperature and pressure. The gas will burn very readily in proper mixtures of air or oxygen. The explosive limits are: lower 4.0%, upper 22.0% by volume in air. An explosion hazard can exist when drawing samples or venting to the atmosphere. Open flames, local hot spots, friction, any spark producing equipment, and static electricity are to be avoided when handling this material.

6.2.3 *POLYMERIZATION HAZARDS*

Vinyl chloride does not form peroxides by autoxidation as readily as many other monomers. Aside from polymerization, vinyl chloride is chemically quite stable (See 2.2 Reactivity). Vinyl chloride can be satisfactorily stored without an inhibitor for short periods if it is kept in steel tanks under refrigeration or at normal atmospheric temperature in the absence of air and sunlight. For shipping purposes inhibitors are employed. Inhibitors, like phenol, when present have hazards of their own, being very toxic (See 7.5).

6.3 Spills and Leakage

6.3.1 Frequent inspections of equipment and vessels containing vinyl chloride should be made to detect or prevent leaks.

6.3.2 If spills or leaks occur, all sources of ignition if required to be present in the area and adjacent areas must be shut off immediately. Only necessary and properly protected personnel should remain in the area (See 6.5).

6.3.3 Spills, unless very large, usually evaporate rather rapidly and do little damage, but ample ventilation should be provided to prevent the formation of toxic and explosive mixtures. Spills should be guarded and controlled immediately. All openings in sewer system should be trapped for segregation and extinguishment. All sources of ignition should be removed (See 6.2.1).

6.3.4 If possible, increased forced ventilation should be provided. Inhalation of vapors should be avoided (See 8).

6.3.5 Leaking cylinders in any enclosure should be removed to an isolated, well-ventilated area and the contents transferred to other suitable containers (See 4.3 and 5.2.2).

6.3.6 The detection of leaks in equipment of vinyl chloride can best be accomplished by the use of a flammable gas indicator, or by inspection for the presence of vapors and frosting on the surfaces of the equipment.

6.3.7 In the event of a tank car leakage, utilize necessary personal protective equipment and make emergency repairs, if possible. The supplier should be telephoned or wired immediately for specific instructions. Guard against the fire hazard or explosion hazard (See 6.2).

6.3.8 Clothing contaminated with vinyl chloride should be removed immediately and the body washed thoroughly to remove any material which may have penetrated to the skin. Clothing should be washed before reuse. If necessary shoes should be replaced with new ones. Disposal of the contaminated shoes is recommended if the spilled vinyl chloride contained a toxic inhibitor, like phenol.

6.4 Employee Education and Training

6.4.1 Safety in handling vinyl chloride and other hazardous chemicals depends upon the effectiveness of employee education, training, and the safety instructions incorporated into job instruction manuals.

6.4.2 The education and training of employees to work safely and to use the personal protective equipment or other safeguards provided for them is a responsibility of supervision.

6.4.3 Employee education and training should emphasize the need of handling vinyl chloride according to the methods outlined in this data sheet.

6.4.4 Before being placed on the job, new or transferred employees should be thoroughly instructed and questioned in respect to the proper handling of vinyl chloride. Employees on the job should be reinstructed periodically.

6.4.5 Each employee should know the location, purpose, use and maintenance of personal protective equipment and be thoroughly trained in when and how to use the equipment (See 6.5).

6.4.6 Each employee should know the location of safety showers, eye baths, bubbler drinking fountains, faucets or fire extinguishing equipment.

6.4.7 Only reliable, properly trained employees should be given the responsibility of operating valves which control the flow of vinyl chloride to and from storage tanks, tank cars, and cylinders, or drawing samples and venting to the atmosphere.

6.4.8 Employees should be trained to report to the proper authority all suspected leaks or equipment failures and any signs of illness of personnel.

6.4.9 Each employee should know what to do in case of an emergency, in rendering first aid measures, and should realize the necessity for prompt administration of artificial resuscitation when overcome by vinyl chloride vapors (See 8.4.2.1).

6.5 Personal Protective Equipment

6.5.1 *AVAILABILITY AND USE*

Personal protective equipment is not an adequate substitute for good, safe, working conditions, adequate ventilation, and intelligent conduct on the part of employees working with vinyl chloride. Such equipment may protect the individual wearing it while others in the area may be exposed to danger. The correct usage of personal protective equipment requires the education of the worker in the proper employment of the equipment available to him (See 6.4). Under conditions which are sufficiently hazardous to require protective equipment, the use of it should be supervised. In all cases, the type of protective equipment selected should depend upon the nature and degree of the hazards existing.

The following personal protective equipment should always be used for the purposes mentioned and as specified in Section 8. Health Hazards and Their Control, and in other sections of this data sheet:

6.5.2 *EYE PROTECTION*

6.5.2.1 *Chemical Safety Goggles:* cup-type or rubber-framed goggles, equipped with approved impact resistant glass or plastic lenses, should be worn whenever there is danger of the vinyl chloride (in liquid or saturated vapor form) coming in contact with eyes. Goggles should be carefully fitted by adjusting the nose piece and head band to ensure maximum protection and comfort.

6.5.2.2 *Spectacle-type Safety Goggles:* metal or plastic rim safety spectacles with perforated side shields which can be obtained with prescription safety lenses or suitable all plastic safety goggles may be used where continuous eye protection is desirable. These types, however, should not be used where complete eye protection against chemicals is needed.

6.5.2.3 *Face Shields:* plastic shields (full length, eight inch minimum) with forehead protection may be worn in lieu of, or in addition to, chemical safety goggles where complete face protection is desirable. Chemical safety goggles should always be worn as added protection where there is danger of vinyl chloride striking the eyes from underneath or around the sides of the face shield.

6.5.2.4 Each employee should know the location of safety showers, eye baths, and bubbler drinking fountains for flushing the eyes.

6.5.3 *RESPIRATORY PROTECTION*

Respiratory protective equipment must be carefully maintained, inspected, cleaned, and sterilized at regular intervals, and always before use by another person. Personnel wearing such equipment must be carefully instructed as to its operation and limitations.

6.5.3.1 *Air or Oxygen Supplied Masks*

6.5.3.1.1 Air or oxygen supplied masks, equipped with full face pieces and approved by the U. S. Bureau of Mines for this purpose, should be used under the following conditions,

and the manufacturer's instructions must be carefully followed:

(a) In emergencies, when the vapor concentration is not definitely known.

(b) When the harmful vapor concentration is over 2 per cent by volume.

(c) When the oxygen content of the air may be less than 16 per cent by volume.

(d) When the exposure period is to be over 30 minutes duration.

(e) In tank and equipment cleaning and repair work under conditions outlined in (a), (b), (c) and (d).

6.5.3.1.2 *Types Generally Available Include:*

(a) *Air-Line Masks* supplied by plant compressed air are suitable for use only where conditions will permit safe escape in case of failure of the compressed air supply. Such masks should be used only in conjunction with a suitable reducing or demand-type valve, excess pressure relief valve, and filter. The compressed air should be checked frequently to make certain that harmful gases from the decomposition of the lubricating oil used in the compressor, or impure air supply, are not present.

(b) *Positive Pressure Hose Masks* supplied by externally lubricated blowers are usually preferred to the air-line type. Since these masks also depend on a remote air supply, they should be used only where conditions will permit safe escape in the event of air supply failure. Care must be taken to locate the blower air source in an area which is free of air contaminants.

(c) *Self-contained Breathing Apparatus* which permits the wearer to carry a supply of oxygen or air compressed in the cylinder, and the self-generating type which produces oxygen chemically, allow for greater mobility. The length of time a self-contained breathing apparatus provides protection varies according to the amount of air or oxygen supply carried. In tank work, where small manholes are encountered, a self-contained breathing apparatus is usually unsuitable because of its bulk.

6.5.3.2 *Industrial Canister Type Gas Masks* equipped with full face pieces and approved by the U. S. Bureau of Mines, fitted with the proper canister for absorbing vinyl chloride vapor (or gas), will afford protection against concentrations not exceeding 2 per cent by volume when used in accordance with the manufacturer's instructions. The oxygen content of the air must be not less than 16 per cent by volume. The masks should be used for relatively short exposure periods only, i.e., less than 30 minutes. They may not be suitable for use in an emergency since, at that time, the actual vapor concentration is unknown and it may be very high. The wearer must be warned to leave the contaminated area immediately on detecting the odor of vinyl chloride. This is an indication that the mask is not functioning properly or that the vapor concentration is too high.

NOTE: Where carbon monoxide may be encountered in addition to vinyl chloride, the mask should be equipped with an "All Purpose Canister" and a "Timing Device" as approved by the U. S. Bureau of Mines.

6.5.3.3 *Chemical Cartridge Respirators* approved by the U. S. Bureau of Mines may be used to avoid inhaling disagreeable but harmless concentrations of vinyl chloride vapor. These respirators, however, are not recommended for protection where toxic quantities of an air contaminator may be encountered.

6.5.4 *HEAD PROTECTION*

6.5.4.1 Safety or "hard" hats will provide protection against accidental liquid leaks, falling tools, and other objects.

6.5.4.2 Brimmed felt hats may be substituted for a safety hat where danger of falling objects is remote.

6.5.5 *FOOT PROTECTION*

High leather or synthetic rubber safety shoes with built-in steel toe caps are recommended where there is danger of heavy objects falling on workman's foot. Liquid vinyl chloride penetrates leather, and shoes wet with vinyl chloride should be replaced.

6.5.6 *BODY, SKIN AND HAND PROTECTION*

6.5.6.1 Any work gloves, clothing or wearing apparel which becomes contaminated with vinyl chloride should be removed immediately, and the body should be thoroughly washed. All contaminated work gloves, clothing or wearing apparel should be thoroughly washed, and dried before reuse. For care of contaminated shoes see 6.5.5.

6.5.6.2 When cleaning, inspecting, or repairing tanks, safety equipment such as safety

belts, rescue harness, lifeline, clothing and gas masks should be worn as required by the specific nature of the work and the hazards involved.

6.5.6.3 Frequent inspections and necessary repairs should be made to all personal protective equipment so that it is always ready to give proper protection to the wearer.

6.5.6.4 Facilities for personal cleanliness should be provided and time allowed for thorough washing before lunch and at the end of the work day.

6.6 Engineering Controls

6.6.1 Selection of a site or location for apparatus or equipment to ship, handle, store or manufacture vinyl chloride should be made by the direction of chemical engineers or mechanical engineers fully aware of the hazards encountered in dealing with vinyl chloride (See 5.2.2).

6.6.2 Processes should be designed so that the operating personnel will not be exposed to direct contact with vinyl chloride or its vapor. The technical problems of designing equipment, providing adequate ventilation, and formulating operational procedures which promise maximum security and economy, can be handled best by engineers or other competent personnel. The manufacturers of vinyl chloride, and of the equipment in which it is to be used, are always prepared to help with these problems (See 5.2.1).

6.6.3 In the handling of vinyl chloride or operation of any type of vinyl chloride system, all valves, pipe lines, vents, safety devices, etc., should be so located that they can be readily inspected and repaired. They should always be in proper order and condition before the operation is started. All handling and storage equipment should be located away from any source of sparks, flames, heated surfaces and all sources of ignition which might cause fires or explosions. All charging and discharging pipes should enter through, or extend to, the bottom of all containers to minimize vaporization of the liquid and possible generation of static electricity.

6.6.4 It is essential for safety that equipment will be used and maintained as recommended by the manufacturer and that a periodic test schedule of the equipment, including safety devices, should be followed. All vent lines should extend outdoors to an area free of any source of ignition for discharge.

6.6.5 All electrical installations should conform with the National Electrical Code. All equipment should be properly grounded to prevent accumulation of static.

6.7 Ventilation

6.7.1 If the workroom or operating area is separate from vinyl chloride storage or processing equipment, general ventilation is adequate. For emergencies, however, the area should be provided with mechanical exhaust ventilation to maintain concentrations below flammable limits.

6.7.2 In the processing or storage area, if outside location is impracticable, special emergency equipment for ventilation is necessary under abnormal conditions, such as leaks or spills.

6.7.3 Six or more changes of air per hour are considered adequate for buildings housing storage or processing equipment for flammable liquids, vapors, or gases under pressure.

6.7.4 Buildings of substantial construction should have at least one square foot of door, window, or nonrigid roof area for each 35 cubic feet of volume to prevent serious structural damage in the event of explosion within the building.

6.7.5 The most important consideration in ventilation is to ensure an adequate air flow away from the work area.

6.7.6 All ventilating systems should be inspected periodically and maintained in a safe and efficient working condition.

6.7.7 Under abnormal conditions, such as when leaks or spills occur, all available ventilation should be used.

6.8 Tank and Equipment Cleaning and Repairs

6.8.1 The hazardous nature of tank or vessel inspections, cleaning, and repairs requires that the foreman and crew be selected, trained, and drilled carefully. They should be fully familiar with the hazards and safeguards necessary for the safe performance of the work. Use only spark-resistant tools.

6.8.2 Wherever possible, vessels should be cleaned from the outside, using cleanout manholes or openings provided for this purpose.

6.8.3 First consideration in vessel entry work requires the vessel be properly isolated

from any process equipment, pipe lines, or apparatus. These process lines, pipe lines, and apparatus should be disconnected, preferably by removing a complete small section and providing a blank flange on the open end to protect against human error and unsuspected leaks. Valves and plug cocks in the process lines, pipe lines, or apparatus should not be relied upon to prevent leakage into vessel being cleaned.

6.8.4 Electrical switches should be locked in the "OFF" position and tagged with a warning that they are not to be opened. Where possible, the fuses should be pulled. Drive belts should be removed and all other precautions taken to ensure against the accidental starting of agitating equipment or other moving parts inside the vessel or adjacent to the entrance.

6.8.5 Before entering a tank, it should be empty, purged, and tested for flammable residues. Caution should be exercised in checking for trapped vapors in any semi-solid or solid residues. In purging a vessel, an inert gas (carbon dioxide or nitrogen) is recommended. The inert gas must be displaced before allowing entry into a vessel. When air is used for purging a vessel, there is a period when an explosive mixture is present (mixture contains by volume between 4-22% gas). For this reason it is best to avoid the use of air in removing flammable vapors.

6.8.6 Warning signs should be placed indicating nature of hazard present during preparation of vessel for entry or repair.

6.8.7 Before entering a vessel and during the course of the work, tests should be made by a qualified person to determine that no further purging or washing is necessary, that no oxygen deficiency exists, and that no harmful gas or vapor is present.

6.8.8 Special ventilation and a continuous fresh air purging of vessel is recommended during the entire time men are cleaning, inspecting, or repairing vessel.

6.8.9 Proper personal protective equipment such as a safety belt, rescue harness, lifeline, or mask as required should be worn by anyone entering a vessel after preparation for inspection, and/or repairs (See 6.5).

6.8.10 An attendant should be stationed outside the vessel in such a position as to keep workmen within the vessel under constant observation. He should serve as the lifeline tender and be ready at all times to summon help or other required aid. He should never abandon the lifeline while workmen are in the vessel.

6.8.11 A self-contained breathing apparatus or an air-supplied mask should be located immediately adjacent to vessel repair area for any emergency situation during vessel entry work. In addition a lifeline and safety harness should be on hand.

6.8.12 The portable electric lights and power tools should be in good condition, grounded and approved by competent persons for use in exposures of this nature.

6.8.13 Before reuse, the vessel should be purged free of air by using an inert gas such as carbon dioxide or nitrogen.

6.9 Repackaging

6.9.1 Only clean, ICC Specification cylinders or tank cars should be used (See 3.1).

6.9.2 Adequate ventilation should be provided and all sources of ignition removed from transfer area.

6.9.3 Proper personal protective equipment should be used (See 6.5). Transferring vinyl chloride from cylinders by the use of an uncontrolled heating method is not recommended because it is unsafe, wasteful, and time consuming. Temperatures of over 50°C. (122°F.) should not be applied to any part of a cylinder containing compressed gas. Excessive heating weakens the structural characteristics of the metal and may seriously damage the cylinder. Low melting safety devices may reach the fusing point by the application of excessive heat to a cylinder. Never apply direct flame to a cylinder. A definite fire hazard is created. For recommended practice to transfer contents of a cylinder see 4.3.

6.9.4 For recommended practice to transfer contents of tank car see 4.4.

6.9.5 The appropriate labels should be applied to the filled cylinders or tank cars (See 3.2).

7. WASTE DISPOSAL

7.1 All Federal, State, and local regulations regarding health and pollution should be observed. Disposal of waste material, however, depends to a great extent upon surroundings and weather conditions.

7.2 When it becomes necessary to dispose of vinyl chloride as such, it is preferable to do so as a vapor, venting to an area free of any source of ignition (See 5.2.5 and 5.2.6).

7.3 When a waste disposal problem arises as a result of a major spill or equipment rupture, only properly protected and qualified personnel should remain in the area (See 6.3 and 6.5).

7.4 Waste mixtures containing vinyl chloride should not be allowed to enter drains or sewers as serious explosion in such systems may result (See 6.3).

7.5 Removal of inhibitor, such as phenol in form of sodium phenolate, should be done by dilution to approximately 1% solution (See SD-4, Part 7. Waste Disposal).

8. HEALTH HAZARDS AND THEIR CONTROL

8.1 Hazards

8.1.1 *GENERAL*

Aside from the risk of fire or explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted maximum allowable concentration is 500 ppm.

8.1.2 *SYSTEMIC EFFECTS*

In concentrations well above 500 ppm. vinyl chloride acts as a mild general anesthetic.

8.1.3 *LOCAL EFFECTS*

In contact with the skin vinyl chloride *is irritating.* Prolonged contact will result in refrigeration and freezing.

8.2 Prevention and Control

Vinyl chloride is not a serious industrial hazard provided precautions are taken to avoid leaks or spills which might provide a fire or explosion hazard. Where serious leaks or spills do occur, the workmen present in the area should be evacuated, and persons returning to the area to repair or clean up equipment should be provided with appropriate gas masks, self-contained oxygen units, or air supplied hoods.

8.2.1 *EMPLOYEE EDUCATION* (See 6.4 Employee Education and Training)

Employees working in areas where vinyl chloride is handled or stored should be thoroughly and repeatedly warned of the anesthetic properties of vinyl chloride gas and instructed as to what to do if anesthetic effects are detected in themselves or in others (See 8.4.2.1).

Emphasis in training should be placed on:

1. *The use of artificial respiration in cases where breathing has stopped because of deep anesthesia.*
2. *The necessity of immediate removal of contaminated clothing and shoes in case of liquid spills.*
3. *Repeated washing of the eyes with copious amounts of water in case of liquid splashes.*

8.2.2 *VENTILATION*

Work areas where vinyl chloride is handled or stored should be provided with adequate ventilation. The concentration of vinyl chloride should be kept below the upper safe limit of 500 ppm. at all times.

8.3 Personal Protective Equipment

8.3.1 No personal protective equipment is an adequate substitute for safe working conditions and intelligent conduct on the part of employees who work with vinyl chloride. Furthermore, the correct usage of personal protective equipment requires education of the worker in the proper employment of the materials available to him. Under conditions which are sufficiently hazardous to require personal protective equipment, the use of it should be supervised.

8.3.2 Employees who may be subjected to severe exposure to vinyl chloride, as in tank and equipment cleaning and repairs, in decontaminating extensive areas after large spillage, or in cases of failure of piping or equipment, should be provided, when indicated, with proper eye, respiratory, skin, and mucous membrane protection as follows:

(a) Suitable gas tight safety goggles.

(b) Rescue harness and life line for those entering tank or enclosed storage space (See 6.7).

(c) Hose masks with hose inlet in a vapor-free atmosphere, air line masks with proper reducing valve and filter, suitable for use only where conditions will permit safe escape in case of failure of the compressed air supply, or self-contained breathing equipment with stored oxygen or air (such equipment allows greater mobility but usually requires more highly trained men).

8.3.3 Facilities for washing eyes and skin with large quantities of water should be readily available (See 6.5.2.4).

8.4 First Aid and Medical Care

8.4.1 *GENERAL PRINCIPLES*

8.4.1.1 As in exposure to any odorless or mildly scented anesthetic gas, a recognition of the presenting symptoms and signs in oneself and in others is very important. The anesthetic properties of vinyl chloride are mild in degree and slow in developing. Detection of symptoms except in very high concentrations permits ample warning and sufficient time for escape from the environment provided the warning is heeded and escape is possible.

8.4.1.2 As in any skin contact with irritating or harmful materials, speed in removing the contaminant from the skin is of primary importance. Vinyl chloride is very volatile and simple exposure to air will usually effect adequate removal. Clothing, shoes, bandages, or other articles by which vinyl chloride might be held in contact with the skin should be immediately removed to decrease the freezing effect.

8.4.2 *SPECIFIC ACTIONS*

8.4.2.1 *Inhalation*

Continued exposure to atmospheres containing vinyl chloride in concentrations of 1000 ppm. or over will slowly produce evidences of mild anesthesia: (1) a sensation of drowsiness and inability to concentrate, (2) a blurring of vision—at first readily cleared by conscious effort—later controlled only with difficulty or not at all, (3) staggering gait, (4) sensation of numbness or tingling in feet or hands or both.

These symptoms may be readily detected by the employee himself if he has been alerted to the possibility of their arising from overexposure to vinyl chloride. They may also be noted in fellow employees. When such symptoms arise, they are definite warning of a hazardous exposure to vinyl chloride, and all personnel should be immediately evacuated from the area until the leak or spill has been located and corrected and until complete recovery from all symptoms has occurred.

Because of the mildness and slow development of symptoms, it is very unlikely that any workman will be overcome to the point where he will require help in escaping the environment or medical care following exposure. Any person with evidence of intoxication from vinyl chloride should be put at rest, either seated or lying, in an uncontaminated atmosphere.

If trapped in an area of high concentration where escape is impossible, deep anesthesia can result. If such an exposure has occurred, the patient should be placed in bed, preferably with the head slightly lowered and with no pillows. If respirations have ceased, artificial respiration will be required. In any case, medical attention should be obtained immediately.

8.4.2.2 *Contact with Skin*

Liquid vinyl chloride is a primary irritant to intact skin. If sufficient quantities remain long enough in contact with the skin, the rapid evaporation may result in freezing or "frost bite". Consequently, anything which tends to hold vinyl chloride in contact with the skin, such as clothing, shoes, or bandages, increases the risk of freezing.

If spills occur, all contaminated clothing should be removed immediately and the contaminated area washed copiously in running water. If mild irritation has occurred, no further treatment may be required. If inflammation is severe, loose dressings of petroleum jelly should be applied and the patient placed in the care of a physician.

If freezing has occurred, the area should be loosely covered with a clean, preferably sterile, gauze or towel and placed in the care of a physician.

8.4.2.3 *Contact with Eyes*

Vinyl chloride which has gotten into the eyes should be washed out immediately with copious amounts of flowing water. Water at room temperature will produce less pain than very cold water, but in an emergency a drinking fountain is a satisfactory source of water. The washing should continue for at least 15 minutes. If injury is apparent in the tissues of the eye after 15 minutes of irrigation, the washing should be continued for another 15 minutes. In all cases except of very minor irritation, the patient should be placed in the care of an ophthalmologist immediately.

The medical information in this publication has been supplied by the Medical Advisory Committee of the Manufacturing Chemists' Association, Inc.

CHEMICAL SAFETY DATA SHEETS

*Acetaldehyde	(1952)	SD-43
Acetic Acid	(1951)	SD-41
Acetic Anhydride	(1962)	SD-15
*Acetone	(1962)	SD-87
Acetylene	(1957)	SD-7
*Acrolein	(1961)	SD-85
*Acrylonitrile	(1964)	SD-31
Aluminum Chloride	(1956)	SD-62
Ammonium Dichromate	(1952)	SD-45
*Ammonia Anhydrous	(1960)	SD-8
*Ammonia Aqua	(1947)	SD-13
*Aniline	(1963)	SD-17
Antimony Trichloride (Anhydrous)	(1956)	SD-66
Arsenic Trioxide	(1956)	SD-60
*Benzene	(1960)	SD-2
*Benzyl Chloride	(1957)	SD-69
Benzoyl Peroxide	(1960)	SD-81
Betanaphthylamine	(1949)	SD-32
Boron Hydrides	(1961)	SD-84
*Bromine	(1952)	SD-49
*Butadiene	(1954)	SD-55
*n-Butyllithium in Hydrocarbon Solvents	(1966)	SD-91
*Butyraldehydes	(1960)	SD-78
Calcium Carbide	(1948)	SD-23
Carbon Disulfide	(1967)	SD-12
Carbon Tetrachloride	(1963)	SD-3
*Caustic Potash	(1947)	SD-10
*Caustic Soda	(1947)	SD-9
*Chlorine	(1960)	SD-80
Chloroform	(1962)	SD-89
*Chlorosulfonic Acid	(1949)	SD-33
Chromic Acid	(1952)	SD-44
*Cresol	(1952)	SD-48
*Cyclohexane	(1957)	SD-68
*Diethylenetriamine	(1959)	SD-76
*Dimethyl Sulfate	(1966)	SD-19
Dinitrotoluenes	(1966)	SD-93
*Ethyl Acetate	(1953)	SD-51
*Ethyl Chloride	(1953)	SD-50
*Ethyl Ether	(1965)	SD-29
*Ethylene Dichloride	(1947)	SD-18
*Ethylene Oxide	(1951)	SD-38
Formaldehyde	(1960)	SD-1
*Hydrochloric Acid	(1951)	SD-39
Hydrocyanic Acid	(1961)	SD-67
*Hydrofluoric Acid	(1957)	SD-25
*Hydrogen Peroxide	(1955)	SD-53
Hydrogen Peroxide (Not Exceeding 52%)	(1961)	SD-53—Sup. A
Hydrogen Peroxide (High Strength)	(1961)	SD-53—Sup. B
Hydrogen Sulfide	(1950)	SD-36
*Isopropylamine	(1959)	SD-72
Lead Oxides	(1956)	SD-64
Maleic Anhydride	(1962)	SD-88
Methyl Acrylate and Ethyl Acrylate	(1960)	SD-79
*Methanol	(1948)	SD-22
Methylamines	(1955)	SD-57
*Methyl Bromide	(1949)	SD-35
*Methyl Chloride	(1951)	SD-40
Methylene Chloride	(1962)	SD-86
*Methyl Ethyl Ketone	(1961)	SD-83
*Mixed Acid	(1956)	SD-65
Naphthalene	(1956)	SD-58
*Nitric Acid	(1961)	SD-5
*Nitrobenzene	(1948)	SD-21
Ortho-Dichlorobenzene	(1953)	SD-54
Paraformaldehyde	(1960)	SD-6
paraNitroaniline	(1966)	SD-94
Perchloroethylene	(1948)	SD-24
Perchloric Acid Solution	(1965)	SD-11
*Phenol	(1964)	SD-4
Phosphoric Acid	(1958)	SD-70
Phosphoric Anhydride	(1948)	SD-28
*Phosphorus, Elemental	(1947)	SD-16
*Phosphorus Oxychloride	(1948)	SD-26
*Phosphorus Pentasulfide	(1958)	SD-71
*Phosphorus Trichloride	(1948)	SD-27
Phthalic Anhydride	(1956)	SD-61
Propylene	(1956)	SD-59
Sodium Chlorate	(1952)	SD-42
Sodium Cyanide	(1949)	SD-30
*Sodium, Metallic	(1952)	SD-47
Sodium and Potassium Dichromates	(1952)	SD-46
Styrene Monomer	(1951)	SD-37
Sulfur	(1959)	SD-74
Sulfur Chlorides	(1960)	SD-77
*Sulfur Dioxide	(1953)	SD-52
*Sulfuric Acid	(1963)	SD-20
Tetrachloroethane	(1949)	SD-34
*Toluene	(1956)	SD-63
Toluidine	(1961)	SD-82
Tolylene Diisocyanate	(1959)	SD-73
1, 1, 1-Trichloroethane	(1965)	SD-90
Trichloroethylene	(1956)	SD-14
*Vinyl Acetate	(1959)	SD-75
*Vinyl Chloride	(1954)	SD-56
Zirconium and Hafnium Powder	(1966)	SD-92

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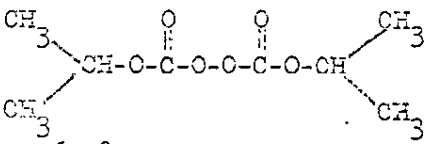
PROPERTIES OF CHEMICALS

IPP CATALYST (Diisopropyl Peroxydicarbonate)

I. Physical Properties:

Formula	
Molecular weight	206.18
Melting point	46° - 50°F
Refractive index, n_D^{20}	1.4034
Specific gravity, 15.5/4°C.	1.080
Solubility in water at 25°C., %	0.04
Solubility in organic solvents	Miscible with aliphatic and aromatic hydrocarbons, esters, ethers, chlorinated hydrocarbons.

II. Toxicity:

Classed as a moderate skin irritant - Vapors can cause eye irritation. Some cases of dermatitis have been observed among people handling it. Also some people are sensitive to its characteristic odor. Adequate ventilation must be provided, and rubber gloves and goggles must be worn for handling. Any material contacting the skin should be washed off promptly with soap and water.

III. Safety Hazards:

IPP Catalyst will decompose when warmed above its melting point to about 57 to 65°F. Decomposition is started by a slow bubbling and shortly afterwards the temperature produces an auto-accelerative decomposition, which may be hazardous if the material is confined. The final stage of decomposition as ordinarily observed is a sudden effervescense, which takes place in only a few seconds time and produces volatile products which are flammable. In the presence of amines or aqueous alkali metal hydroxides, decomposition is accelerated. IPP decomposes on contact with concentrated sulfuric acid. It deflagrates on contact with flame, although ignition is somewhat slower than with other widely used peroxy compounds.

The decomposition products of pure IPP are carbon dioxide - isopropyl alcohol - acetone - acetaldehyde-and ethane. These products are flammable and if a sizable quantity of IPP decomposes, enough heat can be liberated to raise the decomposition products to the auto-ignition temperature.

IPP under the influence of a No. 8 blasting cap and moderate confinement, as in the ballistic mortar test, develops 64% of the energy of black powder. When IPP is tightly confined in a steel pipe and fired by a No. 8 blasting cap augmented by a tetryl booster, fragmentation of the container may take place. IPP in the frozen state is not sensitive to friction and is less sensitive to impact (compression and/or percussion) than black powder.

IV. Packaging and Shipping

IPP is manufactured by the Pittsburgh Plate Glass Co. at plants located in Barberton, Ohio and Lake Charles, Louisiana. The solid material is packaged in 10 lb trays. These trays are placed in a Cardox box for shipment and storage. A Cardox box can contain up to 840 lbs of catalyst and an equal amount of dry ice for cooling. Shipment of smaller quantities is accomplished in similar containers using dry ice for cooling.

Shipment is made by contract carrier under an agreement with the Pittsburgh Plate Glass Co. Shipment can be made in private motor vehicles, but the carrier must comply with ICC tariff No. 13, section 73.218 for "flammable solids".

V. Storage:

The primary storage for solid IPP catalyst should be located at least 60 ft. from regularly used buildings, highways, etc. The catalyst should be kept below 0°F., either by dry ice or mechanical refrigeration. The use of dry ice as a coolant also creates an inert vapor blanket in the storage container that would help confine any possible fire. The storage temperature should be checked frequently. If mechanical refrigeration is used a temperature alarm and separate recording system should be provided.

Solution of IPP-hexane are more stable than solid IPP catalyst. While the storage and handling conditions as mentioned above for solid IPP still generally apply, 20% IPP - hexane solutions can be stored at temperatures up to 40°F. The storage area should be suitably identified as an aid to keep out unauthorized personnel. The material can be stored in simple unheated shelters in properly designed containers. If the primary storage area is also used to make IPP solutions, a properly designed building would have to be provided.

Only small quantities of the catalyst, solid or solution, should be kept in the polymerization area. For the solid IPP, enough for one shift of operation is suggested. For the 20% solution, no more than a one day supply. When stored in a freezer, the unit must have a separate temperature alarm for each compartment.

VI. Use and Application:

Isopropyl percarbonate is used as a catalyst in the polymerization of ethylene, styrene, vinyl acetate, vinyl chloride and many other monomers where polymerization is catalyzed by peroxy compounds. In general a much smaller amount of IPP is required than other peroxy compounds.

IPP catalyst can be used in either solid or solution forms, with most PVC manufacturers using it as a solution in a suitable solvent. B.F.Goodrich has used IPP in the manufacture of Geon 121 as a solid for several years, and for more than a year has used the IPP-hexane solution almost exclusively in various EP resin types at the Henry plant. Other operating plants, including Avon Lake and Louisville, have used IPP-hexane solutions almost completely in the polymerization of EP type resins.

If IPP Catalyst is handled as a solid it should not be confined in a charge bottle or exposed to ambient temperature for more than several minutes or decomposition will result. Since IPP-hexane solutions are more stable, the solutions could remain at the above stated conditions for 20 minutes. However, the solutions should not be removed from storage and added to the charge bottle until ready for charging.

VII. References:

1. Pittsburgh Plate Glass Co. Chemical Division, Market Development Bulletin No. 350, "Isopropyl Percarbonate" (1962).

2. Industrial and Engineering Chemistry, Vol. 56, No. 12, Dec. 1964 Organic peroxides, Diisopropyl Peroxydicarbonate by W. A. Strong.

3. Memos to W. F. Bixby - dated Feb. 26, 1965 - March 22, 1965 and March 24, 1965 by Glen D. Schaaf.

JWG
3-22-67

SAFETY DESIGN CONSIDERATIONS

Rupture Discs and Manual Vents for Polymerizers.

I. General

The objective is to design polymerizer relieving devices for maximum safety and minimum material loss. To accomplish this objective, we have always used some type of rupture disc in Geon polymerizers. However, rupture discs like other relieving devices, have certain disadvantages. Over a period of time, the vacuum support and nozzle assembly become heavily coated with a hard horny polymer, sometimes preventing the disc from blowing at its rated pressure. When an attempt is made to clean the nozzle and vacuum support area, the chances of damaging the disc and causing the premature loss of a charge are greatly increased.

Because of this type of problem, a double disc arrangement has been installed in some of the plants and in all recent Geon expansions. Some of the plants have the primary disc located at the poly with the secondary disc located on top of the vent stack, while others have the two discs in one general assembly. The double disc installation alone is not entirely satisfactory, since small leaks sometimes occur in the primary disc, preventing the primary disc from rupturing at proper burst pressure due to pressure buildup between the two discs and possibly over pressuring the polymerizer.

There have been instances over the years of various types of failures of the vent stack system. Vent stacks have become plugged, causing excessive pressure buildup in the polys. Breaks have occurred in the stacks allowing vinyl chloride vapors to vent inside the operating building. The vent stack failures were due to the following factors:

1. Screwed fittings were used in the vent stacks.
2. Elbows, reducers and other flow restricting devices were used in the vent stack assembly.
3. Vent stack piping was not properly secured to prevent movement.

As a result of the various failures and difficulties the following policy was adopted for Geon polys:

1. Vent stack piping must be the same size as the rupture disc.
2. Vent stacks must be secured to prevent movement.
3. No bends or curves of any sort are permitted in polymerizer vent lines.
4. Vent stacks must be of all welded construction and shall contain no screwed connections in the vent stack itself.
5. Relieving devices should be as close as possible to the equipment they protect.

In general, hazardous vapors of a combustible nature from relief or venting valves and rupture disc venting systems shall be piped, and the system sized, according to B.F.Goodrich policy as found in the Engineering Standard ST-1317 Rev. 3/64 entitled "Policy for Pressure Relieving Devices" by Hugh Spencer.

II. Avon Lake Vent System Design

The polymerizers in the new process building (B-464) are equipped with an insert type, double disc assembly, details of which are shown on Dwg. G-11367. All of the polymerizers are rated at 300 psig, therefore, the rupture discs are rated for 300 psig burst pressure at 72°F. The double rupture disc assembly is equipped with a pressure gage and relief valve in a vent line leading from the area between the two discs back to the relief stack. Should a small leak develop in the lower disc, the pressure indicator will show a pressure. The small relief valve is installed to relieve at a low pressure (10 psig) to prevent "back pressure" from developing, allowing the primary disc to relieve at the rated pressure.

The rupture disc assembly is equipped with a 4" special stainless steel flange (see attached sketch and dwg. G-11367). The flange is located at the bottom of the "Insert" assembly and is drilled with a 1/8" hole angled at the inside to allow the water injection water to spray up on to the vacuum support before entering the poly. Tests at the Avon Lake plant have indicated that the spray system aids in keeping the hard polymer buildup from forming on the vacuum

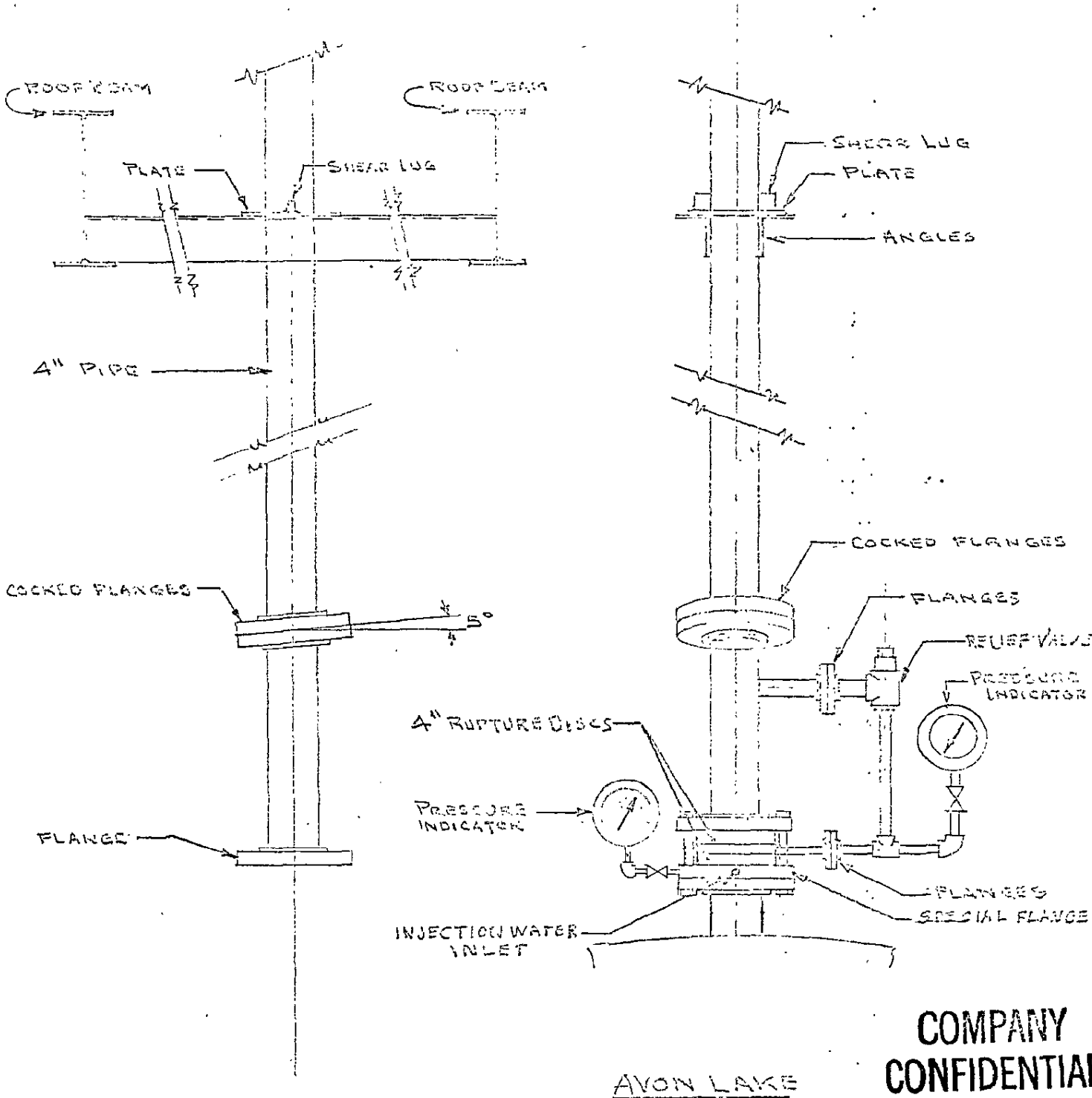
support and in the vent nozzle itself.

The arrangement of the relief assembly on the pearl and plastisol polys, is such that the entire assembly can readily be removed and another unit quickly inserted. The old unit can be serviced and maintained in a "ready" state for re-use at a later date, thus eliminating costly down time.

In addition to the normal rupture disc vent system, each poly is provided with a 3 in. diameter manual vent line. The manual vent line extends from the poly straight up to the roof just as the rupture disc vent line does. The line is equipped with a 3 inch ball valve to allow manual venting in case of a power or steam failure and the pressure in the poly increases. Also, the manual vent can be opened if for some reason the rupture disc assembly fails to burst at its rated pressure -- this problem has actually occurred on more than one occasion in our Geon plants. In emergency cases, where the two vent lines are not adequate to relieve vapors (highly improbable), additional venting can be accomplished through the polymerizer recovery systems.

All polymerizer vent stacks must be equipped with raincaps to protect the rupture disc or relief valve from corrosion. Individual vent stacks from the polymerizers will be carried a minimum of 6 feet above the roof of the building.

JWG
3/21/67



COMPANY CONFIDENTIAL

AVON LAKE
1966 RESIN EXPANSION
POLY RUPTURE DISC ASSY

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NGC36040

Building Ventilation

1. Polymerizer Building

For normal ventilating requirements, the building is equipped with four exhaust fans for each of the three floors. Two fans are single speed units for normal ventilation only and the other two fans are two speed unts for normal and emergency use. The fans are equipped with automatic gravity dampers that are closed when the fans are not in operation. For normal use only the fans are rated as follows:

1st floor - 11,000 CFM each

2nd floor - 9,500 CFM each

3rd floor - 7,000 CFM each

The two speed fans at the lower speed are rated at 12,500, 11,000 and 8,000 CFM for the first, second and third floors respectively. The switches for all of the fans for normal ventilation are located on a panel board in the electrical control room and can be operated individually as needed.

A series of four (the second floor has five) wall mounted inlet dampers are located on the west wall of each floor. When the exhaust fans are turned on for normal ventilation, the pneumatically operated dampers automatically open.

In addition to the four wall fans, the third floor is equipped with two roof exhaust fans. The roof fans are rated at 7000 CFM each and are located over the poly area, the largest source of heat. The operating switches for these fans are also located in the electrical control room.

During VCl spills or other similar emergencies, the emergency fans can be started from two locations on each floor, conveniently located at the stairwell and fire escape exits making it possible to start the fans when leaving the building. When the emergency fan start switch is turned on, an over-ride in the circuit will automatically switch the fans to high speed

if they are already in use for normal ventilation purposes. If the fans were not on, they will start at the high emergency speed and the wall inlet dampers will automatically open. Another over-ride in the third floor emergency fan circuit will shut off the roof fans, closing the gravity operated roof fan damper. Shutting off the roof fans during a spill prevents VCl or other hazardous vapors from being pulled up in to the fans and also keeps the ventilating air from short circuiting the wall inlet dampers by coming in through the roof fan housings.

All of the normal and emergency ventilation fans and wall dampers, with the exception of the roof fans, are located at the floor level. The low level installations will aid in sweeping the heavier-than-air VCl vapors from the building.

Heating requirements are provided by two make-up air units of 27,500 CFM each with a temperature rise from 0°F to 136°F using 200 psig steam in the heating coils. The air intakes for the heating units are located on the west side of the building on the roof of the blend tank storage area (approximately the 2nd floor level). A low pressure steam heating system using fin-tube radiators is provided for the office, toilet and stair tower areas.

The instrument and electrical control rooms are pressurized and have separate ventilation systems. The electrical control room ventilation consists of a two-fan direct driven heating and ventilation unit rated at 7200 CFM for each fan. Normally, the fan unit is driven by an electric motor, but in case of power failure, the unit is operated by a steam turbine with a speed governor capable of delivering the same HP and speed as the electric motor when supplied with 200 psi steam. A register leading from the electrical control room duct work also provides air "for pressurizing only" to the office area.

The instrument control room ventilation is supplied by a similar unit but with the fans rated at 7000 CFM each. Both control room units are equipped with air filters. The air intakes for the control room ventilation systems

are located on the pipe bridge (approximately second floor level) coming from the dryer building on the west side of the poly building, at a distance of 30 ft. from the building. The control rooms are equipped with heavy duty air outlet louvers counter balanced to 0.25" water S.P. before opening.

Details of the heating and ventilation systems for the polymerization buildings are shown on drawings 10951, 10952, 10953, 10954 and 10955.

2. Drying and Warehouse Building

The heating and ventilating system for this area is designed to supply comfort cooling and heating as needed. The primary heating system consists of two roof mounted make-up heating and ventilation units rated at 17,250 CFM with a coil sized to heat from 0°F to 130°F using 30 psig steam. The heating system is supplemented by four door heaters, two units rated at 551,000 BTU per hour and two units rated at 378,000 BTU per hour, and a unit heater rated at 173,000 BTU per hour located at the north building entrance. In addition, a series of fin tube heaters are used to heat the office, toilet and stair tower areas.

Ventilation is provided by five roof exhausters, two rated at 23,250 CFM and the other three rated at 17,450 CFM. The roof exhausters are located in the dryer area of the building. Additional ventilation in the silo area is supplied by two free flow gravity roof ventilators with chain operated dampers. A small blower (1280 CFM) with disposable filters provides ventilation for the electrical control room.

Building Construction

The building is designed to provide explosion relief through the use of steel frame construction with light weight walls and metal deck roofs. The walls are constructed of corrugated cement-asbestos panels with translucent corrugated plastic-fiber glass panels to provide light. The walls are designed and installed to relieve an internal explosive pressure having a minimum of 30 to 35 psf wall pressure. The roof is constructed of steel roof deck of 20 guage strip steel with a Koroseal vapor barrier designed to withstand a maximum upward force of 30 psf.

Sprinkler System

For fire protection, sealed or pressure head sprinkler systems have been provided. In the polymerizer building, the sprinkler system is designed to supply a minimum of 0.35 gpm per square foot on an area or specific coverage basis. In the drying and warehouse building, the sprinkler heads cover a maximum of 100 square feet per head, according to the normal hazard schedule.

A Gamewell fire alarm system consisting of manual alarm stations, sprinkler alarms and code alarm horns is provided and is tied in to the existing plant system. The installation conforms to the standards of the National Board of Fire Underwriters and the Factory Insurance Association.

Fog System

The fog nozzle system is a separate system and is not connected in anyway with the fire sprinkler system. The fog system is not intended to be a fire fighting device, but a fire prevention device. The purpose of the fog nozzle system is to saturate the air with water when a gas escape occurs, reducing the tendency of static sparks to arc and helping to blanket down the flammable vapor clouds so the emergency ventilation system can remove them.

The fog system is a manually operated system. The entire building is divided into six sectors with two equally divided areas per floor. Push buttons to activate the two sectors on a particular floor are located at the main north and south exits of that floor. In addition, any one of the six sectors on any floor can be activated from control areas at the north and south exits on the first floor. The push buttons control the air supply to individual diaphragm valves located in the water supply line to each sector. In case of air failure, the control valves are designed to open, allowing the fog system to operate.

The fog system is made up of a series of brass nozzles with a wide angle, full cone spray pattern designed to blanket each floor with water saturated air. The nozzles have a capacity of 1.13 GPM and a spray angle of 102° at the design operating pressure of 80 psig. At an operating pressure of only 15 psig, the nozzle capacity is 0.51 gpm with an increased spray angle of 120°. Thus, even though the decrease

in pressure occurs, the nozzles will continue to supply fog coverage. The piping in the system is galvanized steel, reducing the possibility of plugging the nozzles with rust scale. A filter is provided in the inlet cooling tower water headers, again to help prevent fouling of the spray nozzles from suspended solids. Air supply fittings are included in the piping of each sector so the lines can be blown empty of water after use, further prevention against scale and build-up fouling.

The fog nozzles will be field located to prevent any possible chance of other lines and objects blocking the water spray. The nozzles are located at a minimum height of 8 feet from the floor level, the minimum distance for maximum spray coverage. Details of the fog spray systems are shown on drawings G-10781, G-10782 and G-10783.

SAFETY DESIGN CONSIDERATION

Poly Cleaning Supervisory and Safety Monitor

General

The basic idea behind the poly cleaning monitoring device is to provide some means of supervising or checking the poly cleaner while he is in the vessel. The design of the monitoring units has varied from plant to plant. Some plants have a four wheeled cart which incorporates the poly cleaning alarm system as well as the cleaning light. The light works in conjunction with the alarm unit and can only be used when the alarm system is activated. Other plants have the alarm system mounted on a cart with the cleaning light mounted on the vessel, eliminating a large cumbersome item from the unit. Generally, all types of units work the same, in that a timer sounds a buzzer after a 4-5 minute interval and a cord must be pulled to silence the buzzer, resetting the timer. If the timer is not reset, an alarm sounds signaling an unsafe working condition.

Avon Lake Design

The design of the poly cleaning monitoring device for the 1966 Resin Expansion follows the same basic concepts as used at other plants and in other areas of the Avon Lake Plant. The major difference is that each polymerizer will have its own individual unit -- no bulky cleaning carts with cords strewn about or unsafe conditions brought about by broken receptacles, frayed cords, etc. Basically, the unit consists of a timer, a pair of amber and red lights, a pull-cord and alarm silencing button, and a central monitoring panel with warning lights for each poly, located in the instrument control room.

The individual units will be operated in the following manner:

A. Normal Safe Work Procedure

1. Unwind the pull-rope from the storage holders.
2. The amber pilot light should light.

Note: If the amber light does not light, assume the

system is inoperative, and report the condition to the person in charge. DO NOT ENTER THE VESSEL.

3. Drop the pull-rope into the manway making sure the handle is in ready reach for a man at work inside the vessel.
4. In 4-1/2 minutes after the amber light was lit, the buzzer will sound to signal the operator to acknowledge a safe working condition by pulling the pull-rope for 1/2 to 1-1/2 seconds. The amber light continues to be lit and steady.
5. Pulling the pull-rope silences the buzzer and starts another 4-1/2 minute work cycle.
6. Repeat 4 and 5 above until the work is completed. Wind up the pull-rope on the storage holders.
7. Amber light goes out. (If the buzzer is sounding at the time, storing the pull-rope will silence the buzzer.)

B. Failure to Acknowledge Buzzer

1. If the operator is unable to acknowledge the buzzer signal within 30 seconds, an alarm condition is started, and the alarm horn will sound alternately on-off-on-off. The amber lights go out and the red lights will flash while the buzzer continues to sound.
2. Someone must be present outside at the top of the vessel to push the alarm silencing button to silence the buzzer and the alarm horn. The alarm condition still persists and the red flashing lights continue to flash.

   Note: If more than one alarm condition is present, it will be necessary to silence each alarm individually at the vessel experiencing the alarms.

3. The alarm condition with red lights flashing continues until the pull-rope is back on the storage holders.

NOTE: If more than one alarm condition is present, it is necessary to replace all the pull-ropes at tanks experiencing simultaneous alarms to stop the flashing red lights.

C. Emergency Call - In case of an emergency, pull the pull-rope for at least three seconds. The alarm condition following is acted upon identically to B-1, 2 & 3.

WASTE INTERCEPTOR

The waste interceptor for the polymerization building is located outside of the building at the southwest corner. The pit is constructed of 10 inch thick reinforced concrete and is made in two separate sections, with an inlet and outlet for each section enabling one to be cleaned out while the other is in use. Each section of the pit is 8 feet wide and 20 feet long with a cat-walk mounted on the dividing wall between the compartments. The top edge of the pit is located approximately 8 inches above ground level and the pit is enclosed with a hand-rail.

Drainage to the interceptor pit is carried by a 15 inch wide trench running from the polymerization building into a small distribution pit. The distribution pit is designed for future installation, if needed, of a weir or screen arrangement to remove large lumps. Two flush mounted, plug drain valves at the bottom of the distribution pit are connected to two 12 inch inlet lines leading to the individual section of the interceptor pit. The bottom of the main pit is sloped toward the inlet end to allow the solids to settle at the deeper end. The pit is designed for possible future installation of a mechanical rake in each section of the pit to aid in moving the solids to the deep end of the basin.

No mechanical means has been provided to empty the interceptor pit, since an outside contractor is currently employed at the Avon Lake plant to pump out the various waste collection pits throughout the plant. However, beam pockets have been located in the pit walls for future installation of a steel beam for supporting rake machinery drives or pumpout pumps.

Dual 12 inch outlet overflow pipes carry the decanted liquid from the pit sections into the industrial sewer line. The pit is similar in design to the unit installed at the Henry PVC plant, but is larger and is divided into two separate sections. All of the intersection of the concrete panels making up the pit walls are sealed with B.F.Goodrich vinyl water stops to prevent leakage. Details of the pit design and construction are shown on B.F.G. drawing G-10786B.

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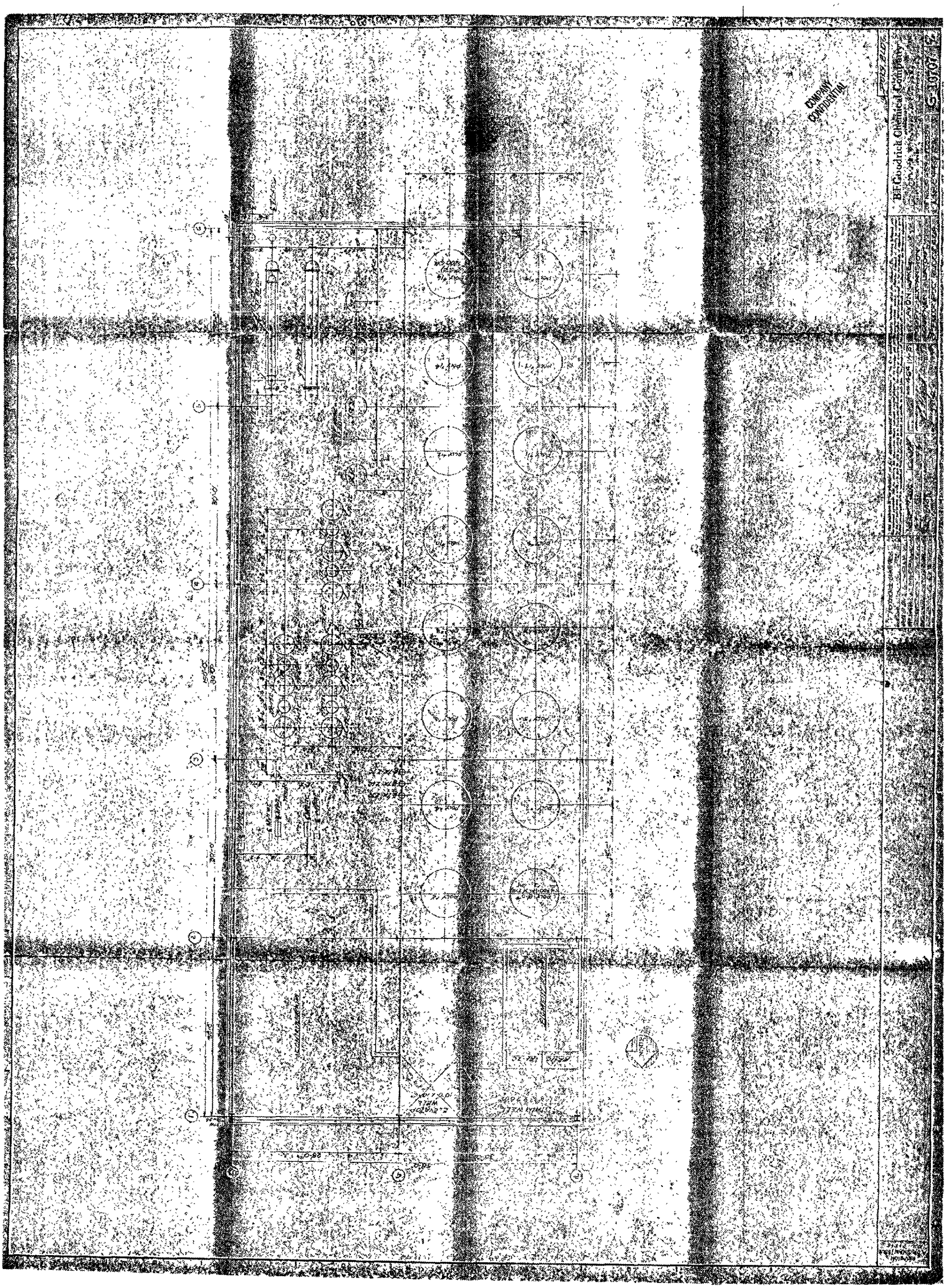
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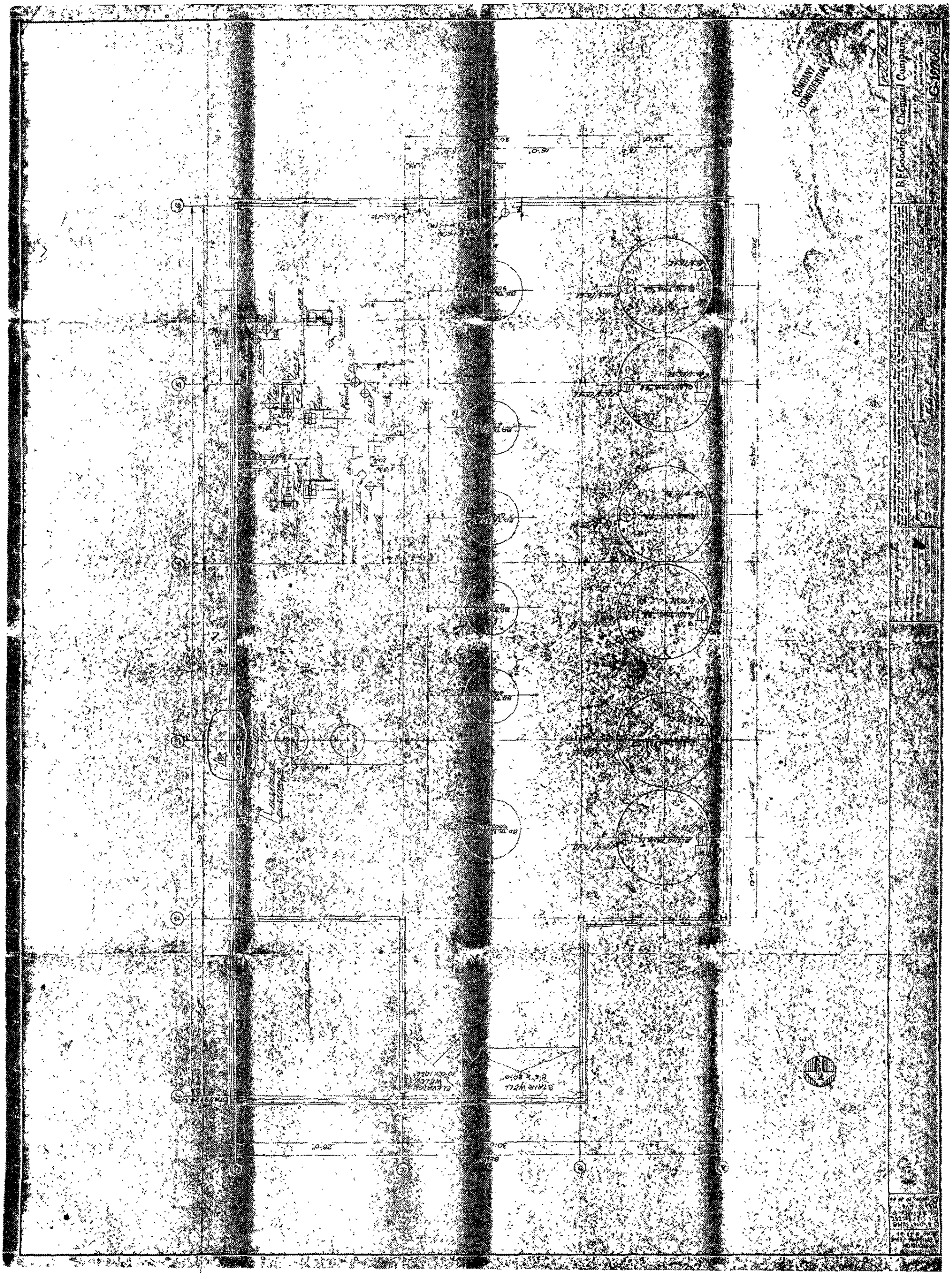

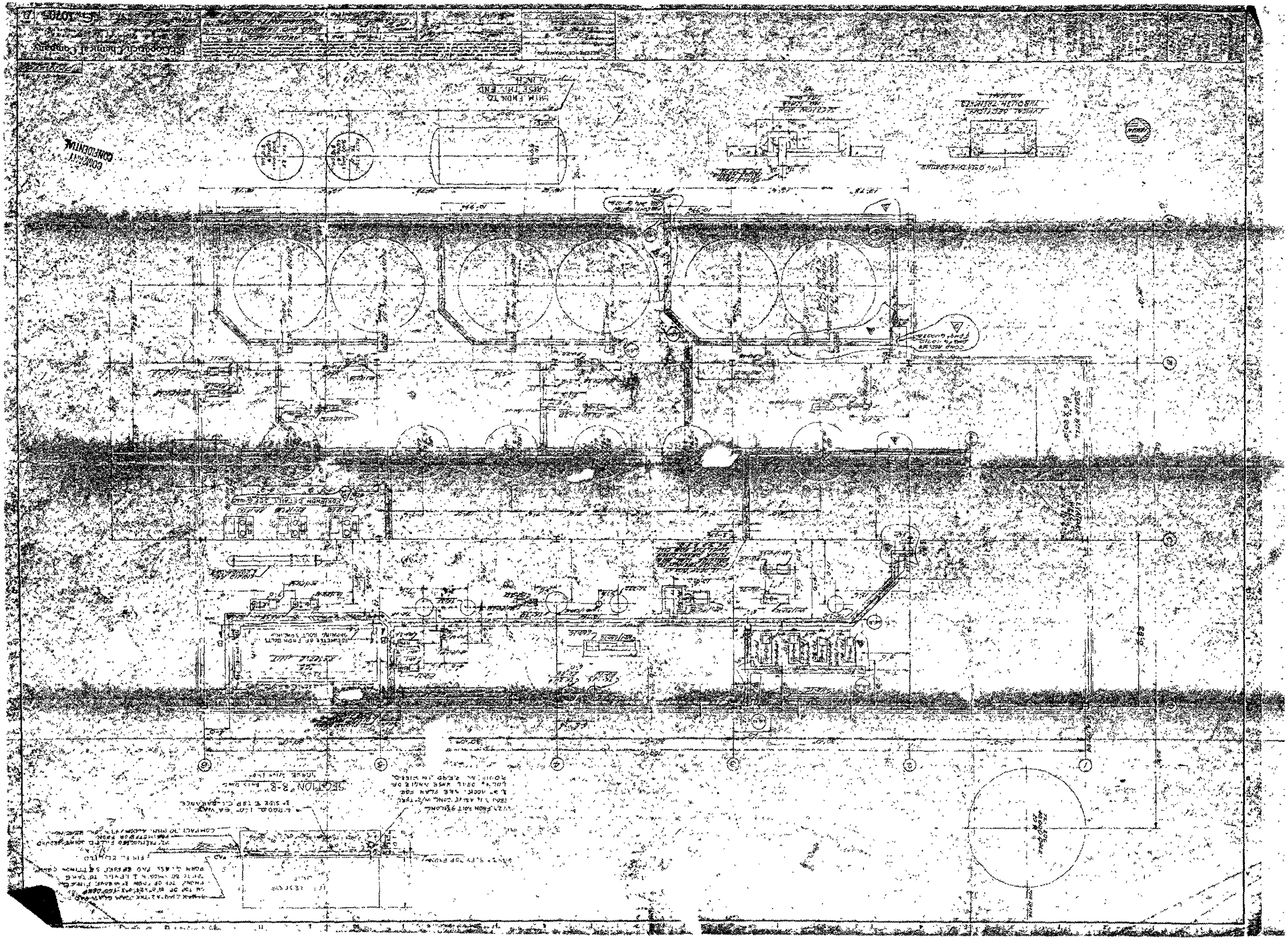

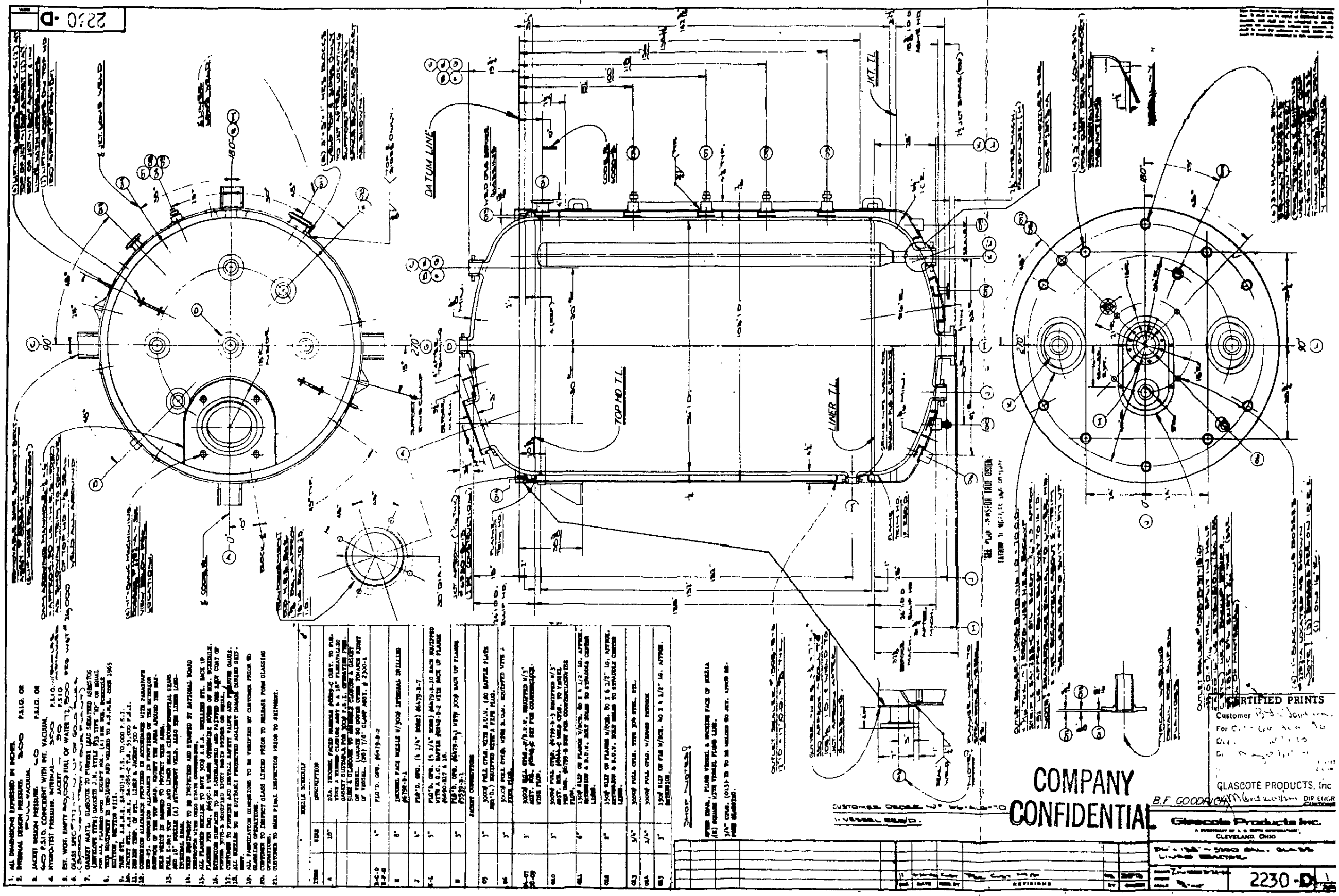

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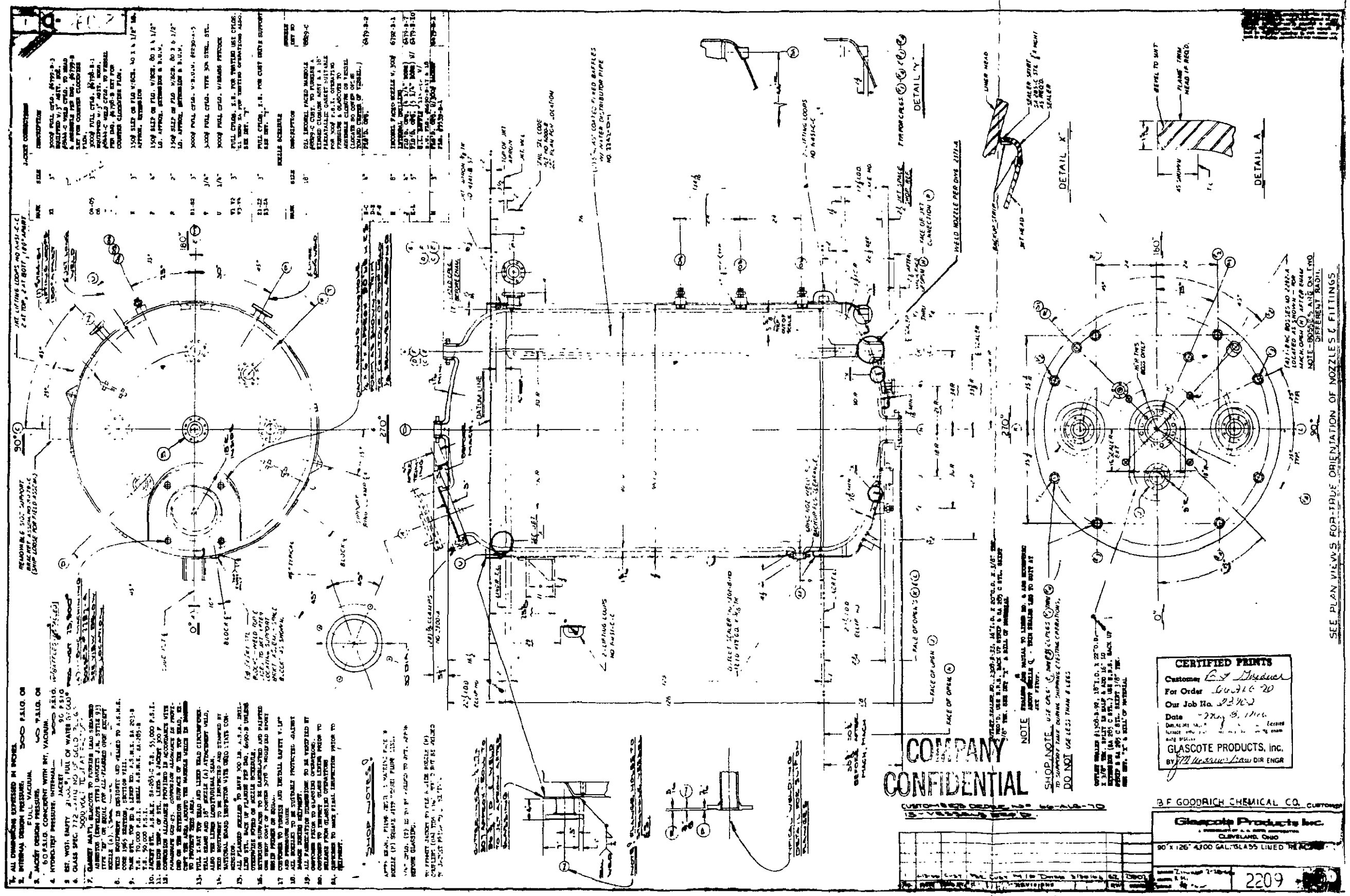

MINUTES OF PROCESS DESIGN REVIEW COMMITTEE

The first meeting of the Process Review Committee to consider process questions regarding the Avon Lake Resin Expansion was held on April 25, 1966 at the Avon Lake Development Center.

In attendance were: R. M. Kreager
L. A. Bennett
G. D. Schaaf
G. W. Saunders
R. W. Seymour
J. W. Goetsch

A. Conclusions and recommendations

1. The basic method of emulsifier makeup and charging as originated at the Henry Plant is acceptable for the Avon Lake Expansion.
2. Buffer charging system as proposed would be adequate for calcium acetate type buffers as used in Geon 110 x 233 resin. System should be adapted to add other types of buffer such as calcium phosphate through charging system.
3. Vacuum requirements for polymerizer charging remain extremely rigorous and provisions will have to be made for pulling, breaking and repulling of vacuum to 2" if initial water is not present.
4. Various agitation recommendations and proposals for the 5200 gallon polymerizer are to be resolved in a meeting with A. A. Etter.
5. Quotes will be obtained for the high pressure water poly cleaning equipment at two conditions - (a) normal operating pressure and water flow rates and (b) conditions suitable for use of a mechanical cleaning device.

B. Discussion

1. The charging flow sheet was reviewed. The group discussed various methods of charging insoluble buffers in an automatic charging system. A system of agitation, circulation and addition by pumping was proposed and will be investigated. The possible substitution of calcium acetate for the calcium phosphate type buffer was discussed.

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2. A discussion of the short stop addition system brought out the fact that plugging may develop in the relatively small header. It was proposed that a portable bottle type addition system may be the best from the standpoint of less plugging in the lines and greater assurance of getting the full amount of short stop into the poly. Production will investigate further before the final decision is made.
3. The experiment at Louisville using the Sellers High Pressure Rotor Jet for cleaning polys was discussed with the committee. It was decided to issue a specification for a high pressure water cleaning pump based on normal operating conditions and those conditions necessary for operation of the Sellers cleaning device - i.e. 6,000 psi and up to 45 GPM per nozzle.
4. The different agitation proposals for the 5200 gallon reactor were discussed and a review of various agitation conditions as provided in existing polymerizers at the various plants was presented by G. W. Saunders. The committee agreed the problem should be discussed with A. A. Etter and resolved at a later meeting.

C. Assignments

1. Production (RWS) to evaluate calcium acetate buffer in 101EPF-24 type resins.
2. Supplier of calcium oxide to be contacted (GDS) to determine if buffer ingredients can be obtained in particle size of such a fineness as to provide a colloidal suspension in the makeup tank and charging system.
3. Engineering (JWG) to investigate the use of a pump for circulation and addition of buffer ingredients to water charging stream.
4. Cold water flush through charging header after VCl-catalyst charging to be checked with Henry Plant (GDS).
5. Production (RWS) to check on short stop addition system.
6. Engineering (JWG) to check on use of steam to break first vacuum during polymerization charging and possible effects on glass lining of vessels.

7. Engineering (JWG) to contact Sellers representative for operating conditions necessary to clean 4300 gallon polymerizers. Also to check with Louisville for latest information on operation of Rotor Jet Cleaning device in 1100 gallon polys.

D. The next meeting of the committee is scheduled for Thursday, April 28th in Cleveland.

John W. Goetsch

cc: A. Vittone - P.H. Lawrence
J. L. Nelson
G. H. Metzger
W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fisk
W. L. Wilkins
S. S. Michels
G. D. Schaaf
L. A. Bennett
R. M. Kreager
R. W. Seymour

MINUTES OF PROCESS DESIGN REVIEW COMMITTEE

Place: Cleveland Office
Date: April 28, 1966

Present: L. A. Bennett
R. M. Kreager
E. L. Paulsen
G. D. Schaaf
R. W. Seymour
H. Spencer
J. W. Goetsch

A. Conclusions and Recommendations

1. It is important to remove initial recovered VCl from low conversion resins as quickly as possible.
2. Basis of 30 minute total recovery time per charge is still sound, although to exceed by 2 or 3 minutes would not be harmful. Initial one-third of recovery is probably most important.
3. A G.P.C. be originated as soon as possible to investigate the problem of formation of polymer in recovered VCl. If possible, the G.P.C. should be done on a short term basis.

B. Discussion

1. The three basic recovery proposals for the Avon Lake Resin Expansion were reviewed by H. Spencer. The conclusion was reached that stopping the reaction as quickly as possible was most important once the proper conversion was reached. Until complete use of short stop is achieved, the best way to stop the reaction is by recovering the unreacted VCl as rapidly as possible.
2. The group decided over-all recovery time is important, but to exceed the figure of 30 minutes, as established for the Henry Resin Plant, by a few minutes would not be detrimental. The first one third of the recovery is probably the most important. Proposals 1 and 2 would require 29 minutes and system #3 would require 32 minutes. The committee agreed, based on the Henry Plant experience, the system should be as simplified as possible. It was brought out during the discussion that several of our competitors use some sort of buffered or alkaline system in the recovery pump seal water media. Reduction of vinyl peroxides due to the caustic media was mentioned.

3. The problem of polymer in the recovered VCl was discussed at some length. It was generally felt that the polymer occurs in two forms - one as entrained polymer carried into the system from the polymerizers, and the other as polymer formed in the recovered VCl itself. Because of the danger of contamination and possible production of less than prime product, the group felt an investigation of the causes of the formation of polymer in the recovered VCl was necessary.

John W. Goetsch

JWG/ckg

cc: A. Vittone
J. L. Nelson
G. H. Metzger
W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fisk
W. L. Wilkins
S. S. Michels
G. D. Schaaf
L. A. Bennett
R. M. Kreager
R. W. Seymour

MINUTES OF AVON LAKE PROCESS DESIGN REVIEW COMMITTEE

Place: Avon Lake General Chemical Plant

Date: May 5, 1966

Present: L. A. Bennett
R. M. Kreager
R. W. McKay
G. D. Schaaf
W. A. Reed
J. W. Goetsch

A. Conclusions and Recommendations

1. The basic concept of one central catalyst charge bottle system should be retained for the Avon Lake Expansion. Because of the necessity to produce three types of resin at one time, three separate charging systems will be provided.
2. The use of three-way valves in the charging headers should be retained provided the headers are completely flushed with water after charging and acceptable valves can be obtained.
3. Since more than one type of short stop will be used, the short stop addition system should be revised to include three bottles, one for each charging station.
4. The committee agreed all 16 polys should be equipped for hydrostatically full polymerization. The Avon Lake Plant will put a 3300 gallon poly into operation for hydrostatically full charging as soon as possible.

B. Discussion

1. The charging system as initiated at the Henry PVC Plant is basically suitable for the Avon Lake Resin Expansion. Due to the necessity of charging three different types of resin at one time, three separate charging systems will be provided with a central catalyst charge bottle in each system. The committee recommended that the piping be arranged to allow the addition of individual bottles in the future, should it become necessary.
2. The short stop addition system as initially shown on the charging flowsheet is workable. With more than one type of short stop, it was felt that the system should be separated into three areas. All headers and lines should be sloped towards the polys to insure proper drainage of the short stop solution into the vessel.

3. The buffer addition area was discussed at length. It was reported that the 101EPF-24 charges using calcium acetate buffer in place of the calcium phosphate "in situ" buffer were polymerized without difficulty. Particle size was normal and the pH of the solutions were 4.5 and 4.8 as compared to the normal range for calcium phosphate buffered solutions of 5.0 to 6.0. An M.A. will be prepared to manufacture 10,000 pounds of 101EPF-24 using calcium acetate as the buffer for testing and evaluation purposes.
4. Because of the many benefits available, the Committee agreed all 16 polys should be equipped for hydrostatically full polymerization. Avon Lake General Chemical will put into operation a 3300 gallon poly for hydrostatically full polymerization as soon as possible. Previous experience with 1100 gallon polys indicates it is necessary to install a third set of blades to provide agitation in the upper portion of the vessel to eliminate buildup on the poly dome. The 3300 gallon poly with bottom entering agitation will be used to determine if additional agitation will be necessary in the 3300 gallon vessels as well as in the 4300 gallon poly for the coming expansion. The new 4300 gallon vessels currently will be equipped with single, bottom entering agitators already on order.

C. Assignments

1. Production (R.W.M.) to initiate M.A. for 10,000 pounds of 101EPF-24 to be polymerized using calcium acetate as the buffer. Development (R.M.K.) to assist with testing and evaluation.
2. Production (R.W.M.) to make hydrostatically full charges in 3300 gallon poly as soon as possible in order to evaluate bottom entering agitation with swept back blades.

John W. Goetsch

JWG/ckg

cc: A. Vittone
J. L. Nelson
G. H. Metzger
W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fisk
W. L. Wilkins
S. S. Michels
G. D. Schaaf
L. A. Bennett
R. M. Kreager

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MINUTES OF AVON LAKE PROCESS DESIGN REVIEW COMMITTEE

Place: Avon Lake Development Center

Date: May 19, 1966

Present: G. D. Schaaf
R. W. Seymour
W. A. Reed
R. Reinhart
J. W. Goetsch

A. Conclusions and Recommendations

1. The hydrostatically full polymerizers should be charged using the technique whereby a known amount of N_2 is added to the vessel.
2. Space should be provided for an automatic palletizing machine in the PVC bagging area. The economic feasibility of the device and the decision to purchase, if needed, can be made once the area is in operation.
3. Slurry pre-heaters should be installed in the centrifuge feed lines for the three dryer lines.

B. Discussion

1. The Polymerization ("D") and Blending ("E") flowsheets were reviewed in detail by the committee. The pros and cons of water injection through the throttle bushing on the drive unit were discussed. Some plants have decided to put all of the injection water through the drive seal. However, there is agreement with the Avon Lake personnel that only the necessary flush water be diverted through the seal and the major portion of the injection water is to be added through a separate injection line. No major changes were indicated on either flowsheet.
2. The method of charging using hydrostatically full polymerization was discussed by the group. It was decided the best procedure would be to use the addition of a predetermined amount of N_2 to the poly after the vacuum is obtained, thus ensuring the presence of a bubble in the vessel. It was agreed the above method would provide the best safety margin for hydrostatically full operation.
3. The problem of whether or not to provide slurry pre-heaters in the dryer building was considered. There are several proposals for

increasing polymerization capacity and the committee felt the additional dryer capacity will be a much needed item at some future date. It will be easier and less costly to install the heaters during the initial construction period.

4. Should an automatic palletizer be provided for PVC bagging? The question was considered and it was decided space should be reserved for a palletizing device. Because of the difficulty in forecasting just how much of the PVC will have to be bagged, the committee felt the decision as to whether a unit is needed or not should wait until the area is in operation.

5. A report was given on the latest operation of the Seller's Rotor Jet for mechanical cleaning of polymerizers. Results from the Louisville plant were considered favorable and it was reported the device cleaned an 1100 gallon stainless steel poly in 20 minutes. Some areas were only partially cleaned due to the location of the jet nozzles with respect to the agitator shaft. Repositioning of the nozzles during the cleaning cycle would eliminate this.

C. Assignments

Engineering (JWG) to determine best method for controlling flow of injection water in hydrostatically full polys.

John W. Goetsch

JWG/ckg
cc: A. Vittone
J. L. Nelson
G. H. Metzger
W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fink
W. L. Wilkins
S. S. Michels
C. D. Schaaf
L. A. Bennett
R. M. Kreager
R. W. Seymour

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MINUTES OF AVON LAKE PROCESS DESIGN REVIEW COMMITTEE

Place: Cleveland Office

Date: June 2, 1966

Present: E. C. Martinelli
D. W. Perdue
W. A. Reed
G. D. Schaaf
R. W. Seymour
J. W. Goetsch

A. Conclusions and Recommendations

1. The dryers should be equipped with some method of removing fines collected in the Aerotec dust collector before going into prime product.

2. Provide the resin transfer area with the flexibility to transfer from the resin transfer units to any of three silos and from any silo to any of the millroom storage tanks.

3. Some form of emergency manual venting should be retained on the polymerizers.

4. Agitation equipment for the 5200 gallon polymerizers should be purchased to enable the application of both proposed agitation systems.

B. Discussion

1. The drying area flowsheets consisting of "G" and "H" flowsheets were reviewed by the committee. D. W. Perdue discussed some of the modifications to be made to the Venturi type dryers versus the Henry Plant installation. Ammeters will be installed along with the torque feed control device to aid in slurry feed operations. Straightening vanes have been installed in the 1st stage heater intake blower to provide more uniform air flow to the blower. The magnets over the

screening area have been separated and relocated individually near the tops of the screen assembly for easy accessibility.

The problem of fines creating fisheyes in critical film applications was discussed and the group agreed a method should be provided to remove the fines discharged from the collector before they enter the prime product stream. It was pointed out during the discussion that the use of heavier guage metal and reinforcement in critical areas of the duct work would prevent reoccurrence of the problems encountered with the Henry Plant dryers.

2. During the "J" flowsheet (Bulk Transfer and Miscellaneous Drying Equipment) review, the question of flexibility in the resin transfer system was considered. The group felt the importance of flexibility -- that is, being able to transfer the resin to the needed areas -- far outweighed the disadvantages of a possible resin mix-up.

3. The pros and cons of manual vent valves on polymerizers were considered at some length. In general, the committee agreed that some type of manual vent system should be retained for emergency purposes. Several methods were discussed, including the installation of a single rupture disc that could be manually broken. However, it was pointed out that a single disc along with the regular double disc assembly would reduce the effectiveness of the double disc assembly as far as loss of charges due to pinhole leaks is concerned. The possibility of using some sort of seal device on the valve in the manual vent system was brought up and seemed like a reasonable solution to indiscriminate use of the vent system. Another method would be to provide a valve under the manual disc to give protection against pinhole leaks.

4. Because of the increased vessel size and possible new resin types and polymerization techniques, the committee felt it would be most useful to have the ability to use both agitation proposals in the 5200 gallon vessel. A. A. Etter has recommended the use of two 50-inch retreating type blades located at 16" and 85" from the vessel bottom and turning at 126 RPM. The proposal suggested by the Process Engineering Department requires one 54" retreating type blade located 16" from the vessel bottom operating at 133 RPM. The group is of the opinion that there is a definite need for the ability to check both agitation systems.

John W. Goetsch

JWG:lhk
cc: A. Vittone - P.H. Lawrence
J. L. Nelson
G. H. Metzger
W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fisk
W. L. Wilkins
S. S. Michels
G. D. Schaaf
L. A. Bennett
R. M. Kreager
R. W. Seymour

MINUTES OF AVON LAKE PROCESS DESIGN REVIEW COMMITTEE

Place: Avon Lake Development Center

Date: June 15, 1966

Present: W. A. Reed
G. W. Saunders
G. D. Schaaf
R. W. Seymour
J. W. Goetsch

A. Conclusions and Recommendations

1. A high pressure water pump should be provided capable of producing the necessary pressures and flow rates required for the use of a mechanical polymerizer cleaning device.

B. Discussion

1. The "X" and "W" Water Treatment flowsheets were reviewed for the group by G. W. Saunders. During the discussion it was pointed out that the clarifier for use at the Avon Lake Plant will be shipped from the Henry Plant. Additional filters and carbon beds will be added to the existing water treatment area to provide the necessary capacity for the expansion. The present degassifier in the D. M. water treatment area will be replaced with a vacuum type degassifier, sharply reducing the problem of bacteria growth. The anion and cation bed exchange capacity, as well as the mixed bed exchange capacity, has been increased to meet the 400 GPM rate needed for the new expansion. Also, 30,000 gallons of capacity have been added to the mixed bed water storage area to provide running time during regeneration cycles.

2. The results of the latest trial of the Seller's Rotor Jet mechanical cleaning device at the Louisville plant were discussed at length. The report was very optimistic, indicating the polys appeared to be even

cleaner than those cleaned manually. Fisheye results corroborated the visual results in that the fisheye count was lower on the mechanically cleaned polymerizers as compared to the control charges. The primary problem encountered was the plugging of the bottom drain valves on the polymerizer preventing the vessel from draining. The 4" polymerizer drain lines with ball valve planned for the Avon Lake Expansion should not provide a draining problem.

Based on the above report, the committee agreed it was necessary to provide a high pressure cleaning pump with the capability of supplying the maximum conditions necessary for the operation of the Seller's Rotor Jet. However, because only stainless steel polymerizers were used in the trial at Louisville, it would be most advantageous to have information on the use of the cleaning device in glass-lined polymerizers.

J. W. Goetsch

JWG:lhk
cc: A. Vittone-P. H. Lawrence
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G. H. Metzger
W. F. Bixby
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R. W. McKay
D. E. Fisk
W. L. Wilkins
S. S. Michels
G. D. Schaaf
L. A. Bennett
R. M. Kreager
R. W. Seymour

MINUTES OF AVON LAKE PROCESS DESIGN REVIEW COMMITTEE

Place: Cleveland Office

Date: July 12, 1956

Present: R. M. Kreager
G. D. Schaaf
R. W. Seymour
H. Spencer
J. W. Goetsch

A. Conclusions and Recommendations

1. A high pressure alarm should be installed to sound when the high pressure valve closes in the recovered VCl line to the low pressure recovery compressors.

2. Add a recorder to the integrator on the vent from the recovery vent condenser in order to provide instantaneous record of the vent rate.

B. Discussion

1. The recovery flow sheets "F" and "F-A" were reviewed for the committee by Hugh Spencer. The primary change for the Avon Lake expansion involves the use of refrigerated water or brine on the primary and vent condensers giving operating conditions of 30 to 35°F and 25 PSIG. The low temperature and pressure were provided in order to reduce the possible formation of vinyl peroxides in the recovery system. As a result, the larger portion of the recovery can be accomplished through a by-pass system (High-pressure System), thereby reducing the number of compressors needed from six to four--greatly simplifying the operation.

There are three separate systems: the High Pressure By-Pass System, the Low Pressure System and the Poly Recovery or Spare System. The Low Pressure and Poly Recovery Systems consist of a Nash 702 compressor in service with an H-6 compressor for each system. Total recovery time per charge should be a maximum of 28 minutes--18 minutes on High Pressure and 10 minutes on Low Pressure Recovery. Full-flow filters will be provided in the liquid, as well as in the gas lines, to remove PVC polymer that may have formed or was carried over into the system. The filters will remove polymer material as small as 10 microns in diameter.

The problem of dumping the carry-over resin from the separators was discussed. The Avon Lake Plant will try a system whereby a pump is used to circulate and pump out the slurry in the separators.

The two 5000 gallon recovered VCl receivers will be equipped with measuring devices enabling the measurement of the amount of VCl recovered from individual charges. Also, the recovered VCl will be weighed back into the charges through a scale tank system. The combination of recovered VCl weigh system and vent loss recorder should provide an accurate accounting of the recovered VCl system. The problem of polymer formation around the excess flow valves in the 5000 gallon recovered VCl storage tanks was brought up. It was pointed out that because of the lower operating temperature and the filters in the system, the formation and accumulation of polymer would probably not be a problem.

In discussing the compressor details ("F-A" flowsheet), it was noted that recorders will be installed to monitor the inlet pressure of the 702 compressors, the interstage pressures and the system

discharge pressures--thus providing a continuous record of the operating conditions of the recovery system. All compressors will have mechanical seals and are to be bronze fitted.

2. The GPC to investigate the formation of polymer in recovered VCl was discussed briefly. It was noted that the Long Beach and Henry Plants will send samples of their recovered VCl to Calvert City for analysis.

3. The progress of hydrostatically full polymerization in the 3300 gallon poly was discussed. The operations have been conducted on an air-free basis (N_2 bubble) with success. The charge size has been increased from the normal charge size of 9500 pounds to 10,200 pounds and is still on the increase. Agitation has not been a problem thus far, and is not expected to be.

C. Assignments

Production (RWS) to follow the application of a pump for circulation and transfer of slurry from the recovery separators.

J. W. Goetsch

JWG:lhk
cc: A. Vittone - P. H. Lawrence
J. L. Nelson
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W. F. Bixby
O. F. Beckmeyer
R. W. McKay
D. E. Fisk
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S. S. Michels
G. D. Schaaf
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R. M. Kreager
R. W. Seymour

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(A) REVISION
ISSUED FOR CONSTRUCTION
KCB 10-25-66

(B) ADDED PU-5F & PU-6F
DFS 12-5-66
12-8-66
12-9-66

MOTORS REQUIRED

HP	SPEED SP'L	900	1200	1800	3600	TYPE	SLIDE BASE	REQ'N	DELIVERY	REMARKS

MOTOR DISTRIBUTION

ITEM	HP	SPEED SP'L	900	1200	1800	3600	FRAME	TYPE	MOUNTING	DRIVE	SLIDE BASE	TAG NUMBER	APPLICATION	PLANT ORDER	EQUIPT. REQ'N.	FOREIGN DWG.	MOTOR FURN. BY	COUPLING FURN. BY	SHEAVES & BELTS BY	REMARKS
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-1C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-2C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-3C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-4C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-5C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1	—	—	—	X	—	SPECIAL	EX	FLANGE	—	—	M-AG-1/TK-6C	EMULSIFIER TANK	2370	20967		VENDOR	—	—	
	1/4	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/TK-10C	BUFFER TANK	2370	21297		VENDOR	—	—	
	1/4	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/TK-11C	BUFFER TANK	2370	21297		VENDOR	—	—	
	1/4	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/TK-12C	BUFFER TANK	2370	21297		VENDOR	—	—	
	25	—	—	—	X	—	284T	EX				M-1/CM-1C	NITROGEN BOOSTER COMP.	2370	21350		BFG			
	100	—	—	—	—	X	365TS	EX	BED R.	COUP.	—	M-1/PU-1C	WATER CHARGING PUMP	2370	21440	S-4436	BFG	VENDOR	—	
	100	—	—	—	—	X	365TS	EX	BED R.	COUP.	—	M-1/PU-2C	WATER CHARGING PUMP	2370	21440	S-4436	BFG	VENDOR	—	
	25	—	—	—	—	X	284TS	EX	BASE	COUP.	—	M-1/PU-3C	WATER INJECTION PUMP	2370	21282	S-4413-B	BFG	VENDOR	—	
	25	—	—	—	—	X	284TS	EX	BASE	COUP.	—	M-1/PU-4C	WATER INJECTION PUMP	2370	21282	S-4413-B	BFG	VENDOR	—	
	200	—	—	—	X	—	447T	EX	BASE	COUP.	—	M-1/PU-5C	HIGH PRESSURE POLY CLEANING	2370	21333	S-4508	VENDOR	VENDOR	—	
	40	—	—	—	—	X	324TS	EX	BASE	COUP.	—	M-1/PU-6C	VCl CHARGE PUMP RECOVERY	2370	21127	S-4421	BFG	VENDOR	—	
	40	—	—	—	—	X	324TS	EX	BASE	COUP.	—	M-1/PU-7C	VCl CHARGE PUMP RECOVERY	2370	21127	S-4421	BFG	VENDOR	—	
	1 1/2							EX				M-1/RF-1C	CATALYST FREEZER	2370	21372	S-4500-B	VENDOR			
	1 1/2							EX				M-1/RF-2C	CATALYST FREEZER	2370	21372	S-4500-B	VENDOR			
	5	—	—	—	X	—	184T	EX	BASE	BELT	—	M-1/BL-1D	POLY EVACUATION BLOWER	2370	21132	S-4493	BFG	—	BFG	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-1/PU-1D	BLOWDOWN TRANSF. PUMP	2370	21128	S-4407	BFG	VENDOR	—	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-1/PU-2D	BLOWDOWN TRANSF. PUMP	2370	21128	S-4407	BFG	VENDOR	—	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-1/PU-3D	BLOWDOWN TRANSF. PUMP	2370	21128	S-4407	BFG	VENDOR	—	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-1/PU-4D	PORTABLE SPARE PUMP	2370	21128	S-4407	BFG	VENDOR	—	
	7 1/2	—	—	—	X	—	213T	EX	BASE	COUP.	—	M-1/PU-5D	SPRAY RING WATER PUMP	2366	21330	S-4490-B	BFG	VENDOR	—	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-1D	POLY #1 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-2D	POLY #2 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-3D	POLY #3 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-4D	POLY #4 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-5D	POLY #5 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-6D	POLY #6 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-7D	POLY #7 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-8D	POLY #8 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-9D	POLY #9 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-10D	POLY #10 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-11D	POLY #11 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-12D	POLY #12 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-13D	POLY #13 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-14D	POLY #14 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	60	—	—	—	X	—	364T	EX	BASE	BELT	—	M-DRV-1/PLY-15D	POLY #15 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	75	—	—	—	X	—	365T	EX	BASE	BELT	—	M-DRV-1/PLY-16D	POLY #16 DRIVE MOTOR	2370	20918		BFG	—	VENDOR	
	7 1/2	—	—	—	X	—	213T	EX	BASE	BELT	—	M-DRV-1/TK-1D	BLOWDOWN TANK #1	2370	21105	S-4408-B	BFG	—	VENDOR	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-DRV-1/TK-2D	BLOWDOWN TANK #2	2370	21105	S-4409	BFG	—	VENDOR	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-DRV-1/TK-3D	BLOWDOWN TANK #3	2370	21105	S-4409	BFG	—	VENDOR	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-DRV-1/TK-4D	BLOWDOWN TANK #4	2370	21105	S-4409	BFG	—	VENDOR	
	5	—	—	—	X	—	184T	EX	BASE	COUP.	—	M-DRV-1/TK-5D	BLOWDOWN TANK #5	2370	21105	S-4409	BFG	—	VENDOR	
	7 1/2	—	—	—	X	—	213T	EX	BASE	BELT	—	M-DRV-1/TK-6D	BLOWDOWN TANK #6	2370	21105	S-4408-B	BFG	—	VENDOR	
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-1E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-2E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	F-2 BOX MOUNTING
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-3E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-4E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-5E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	F-2 BOX MOUNTING
	2	—	—	—	X	—	184	EX	BASE	BELT	—	M-BL-1/TK-6E	BLEND TANK EXHAUST BLOWER	2370	21024	S-4405	BFG	—	VENDOR	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-1E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	F-2 BOX MOUNTING
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-2E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-3E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-4E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-5E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-DRV-1/TK-6E	BLEND TANK AGI. DRIVE	2370	21156	S-4404-B	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-1/PU-1E	SLURRY TRANSF. PUMP	2370	21148	S-4410	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-1/PU-2E	SLURRY TRANSF. PUMP	2370	21148	S-4410	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-1/PU-3E	SLURRY TRANSF. PUMP	2370	21148	S-4410	BFG	VENDOR	—	
	20	—	—	—	X	—	256T	EX	BASE	COUP.	—	M-1/PU-4E	PORT. SLURRY TRANSF. PUMP	2370	21148	S-4410	BFG	VENDOR	—	
	1	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/SE-1F	KNOCKOUT TANK AGITATOR	2371	20930	S-4427-A	VENDOR	—	—	
	1	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/SE-2F	KNOCKOUT TANK AGITATOR	2371	20930	S-4427-A	VENDOR	—	—	
	1	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/SE-3F	KNOCKOUT TANK AGITATOR	2371	20930	S-4427-A	VENDOR	—	—	
	1	—	—	—	X	—	182	EX	FLANGE	—	—	M-AG-1/SE-4F	KNOCKOUT TANK AGITATOR	2371	20930	S-4427-A	VENDOR	—	—	
													RECOVERY BOOSTER COMP.	2371	21619	S-4723	BFG	VENDOR	—	
	7 1/2	—	—	—	X	—	213T	EX	BED R.	COUP.	—	M-1/PU-1F	RECOVERY PUMP	2371	21491	S-4432	BFG	VENDOR	—	
	7 1/2	—	—	—	X	—	213T	EX	BED R.	COUP.	—	M-1/PU-2F	RECOVERY PUMP	2371	21491	S-4432	BFG	VENDOR	—	
	20	—	—	—	—	X	256T	EX	BED R.	COUP.	—	M-1/PU-3F	SEAWATER PUMP	2371	21579		BFG	VENDOR	—	
	1	—	—	—	—	X	56T	EX	BED R.	COUP.	—	M-1/PU-4F	SEAWATER STRIPPING TK. PUMP	2371	21575		VENDOR	VENDOR	—	
(B)	15	—	—	X	—	—	284T	EX	BED R.	COUP.	—	M-1/PU-5F	CHILLED WATER PUMP	2371	21608		BFG	VENDOR	—	
(B)	15	—	—	X	—	—	284T	EX	BED R.	COUP.	—	M-1/PU-6F	CHILLED WATER PUMP	2371	21608		BFG	VENDOR	—	
	20	—	—	—	—	X	256T	EX	BED R.	COUP.	—	M-1/PU-7F	SEAWATER PUMP	2371	21579		BFG	VENDOR	—	
	40	—	—	—	X	—	324T	EX	BASE R.	V-BELT	X	M-CM-1F	1ST STAGE COMPRESSOR	2371	21085		BFG	—	VENDOR	
	150	—	—	—	X	—	445T	EX	BASE R.	COUP.	—	M-CM-2F	2ND STAGE COMPRESSOR	2371	21085		BFG	VENDOR	—	
	40	—	—	—	X	—	324T	EX	BASE R.	V-BELT	X	M-CM-3F	1ST STAGE COMPRESSOR	2371	21085		BFG	—	VENDOR	
	150	—	—	—	X	—	445TS	EX	BASE R.	COUP.	—	M-CM-4F	2ND STAGE COMPRESSOR	2371	21085		BFG	VENDOR	—	
	25	—	—	—	—	X	284TS	EX	BASE R.	COUP.	—	M-CM-9F	REC. VENT BOOSTER COMP.	2371	21619	S-4723	BFG	VENDOR	—	

COMPANY CONFIDENTIAL

REFERENCE DRAWINGS

APPROVED 11/1/66

AVON LAKE GEN. CHEMICALS PLANT
1966 COMPOUND AND RESIN EXPANSION
MOTOR LIST FOR FLOW SHEET NOS. "C", "D", "E", "F"

B.F.Goodrich Chemical Company
A Division of The B. F. Goodrich Company
3135 Euclid Avenue, Cleveland 15, Ohio

JOB NO. [illegible]-1558
E.X. NO. 8439

E-4289 REV. B

MOTORS REQUIRED

HP	SPEED SP'L	900	1200	1800	3600	TYPE	SLIDE BASE	REQ'N	DELIVERY	REMARKS	HP	SPEED SP'L	900	1200	1800	3600	TYPE	SLIDE BASE	REQ'N	DELIVERY	REMARKS

MOTOR DISTRIBUTION

ITEM	HP	SPEED SP'L	900	1200	1800	3600	FRAME	TYPE	MOUNTING	DRIVE	SLIDE BASE	TAG NUMBER	APPLICATION	PLANT ORDER	EQUIP'T REQ'N.	FOREIGN DWG.	MOTOR FURNISHED BY	COUPLING FURNISHED BY	SHEAVES AND BELTS BY
	20	—	—	—	X	—	256T	EX		BELT		M-1/BL-1H	1ST STAGE INLET AIR BLOWER (1H)	2372	20963		BFG	——	VENDOR
	20	—	—	—	X	—	256T	EX		BELT		M-1/BL-2H	1ST STAGE INLET AIR BLOWER (2H)	2372	20963		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX	BASE	BELT	—	M-1/BL-3H	2ND STAGE EXHAUST BLOWER (1H)	2372	20964		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX	BASE	BELT	—	M-1/BL-4H	2ND STAGE EXHAUST BLOWER (2H)	2372	20964		BFG	——	VENDOR
	75	—	—	—	X	—	365TS	TEFC		COUP.		M-1/BL-5H	1ST STAGE EXHAUST BLOWER (1H)	2372	20964		BFG	VENDOR	——
	75	—	—	—	X	—	365TS	TEFC		COUP.		M-1/BL-6H	1ST STAGE EXHAUST BLOWER (2H)	2372	20964		BFG	VENDOR	——
	15	—	—	—	—	X	254T	EX		BELT		M-1/BL-7H	COLD POWDER EXH. BLOWER (1H)	2372	20965		BFG	——	VENDOR
	15	—	—	—	—	X	254T	EX		BELT		M-1/BL-8H	COLD POWDER EXH. BLOWER (2H)	2372	20965		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-9H	STORAGE BIN #1 EXHAUSTER (1H)	2372	20965		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-10H	STORAGE BIN #1 EXHAUSTER (2H)	2372	20965		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-11H	STORAGE BIN #2 EXHAUSTER (1H)	2372	20965		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-12H	STORAGE BIN #2 EXHAUSTER (2H)	2372	20965		BFG	——	VENDOR
	40	—	—	—	X	—	364U	EX		BELT		M-1/CE-1H	DRYER (1H) DRYER CENTRIFUGE	2372	20706		BFG	——	VENDOR
	40	—	—	—	X	—	364U	EX		BELT		M-1/CE-2H	DRYER (2H) DRYER CENTRIFUGE	2372	20706		BFG	——	VENDOR
	60	—	—	X	—	—	404TS	TEFC	BASE	COUP.	—	M-1/CM-1H	DRYING AIR BLOWER (1H)	2372	21057		BFG	VENDOR	——
	60	—	—	X	—	—	404TS	TEFC	BASE	COUP.	—	M-1/CM-2H	DRYING AIR BLOWER (2H)	2372	21057		BFG	VENDOR	——
												M-1/CV-1H	1ST STAGE FEEDER CONVEYOR VIBRATOR (1H)						
												M-1/CV-2H	1ST STAGE FEEDER CONVEYOR VIBRATOR (2H)						
	3/4	—	GEARHEAD					EX				M-1/FL-1H	1ST STAGE FEEDER CONVEYOR DRIVE (1H)				VENDOR		
	3/4	—	GEARHEAD					EX				M-1/FL-2H	1ST STAGE FEEDER CONVEYOR DRIVE (2H)				VENDOR		
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-3H	1ST STAGE OUTLET CONVEYOR (1H)	2372	21362	——	VENDOR	——	——
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-4H	1ST STAGE OUTLET CONVEYOR (2H)	2372	21362	——	VENDOR	——	——
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-5H	2ND STAGE OUTLET CONVEYOR (1H)	2372	21362	——	VENDOR	——	——
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-6H	2ND STAGE OUTLET CONVEYOR (2H)	2372	21362	——	VENDOR	——	——
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-7H	AEROTEC OUTLET CONVEYOR (1H)	2372	21362	——	VENDOR	——	——
	3/4	—	GEARHEAD				56-S	TE-3V	SPECIAL	GEAR	—	M-1/CV-8H	AEROTEC OUTLET CONVEYOR (2H)	2372	21362	——	VENDOR	——	——
	5	—	—	—	X	—	184T	EX	BASE	BELT		M-1/PK-1H	BAG PACKER (1H)	2372			BFG		
	5	—	—	—	X	—	184T	EX	BASE	BELT		M-1/PK-2H	BAG PACKER (2H)	2372			BFG		
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-1H	ROTEX SCREENER (1H)	2372	20915		BFG	——	VENDER
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-2H	ROTEX SCREENER (2H)	2372	20915		BFG	——	VENDER
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-3H	ROTEX SCREENER (1H)	2372	20915		BFG	——	VENDOR
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-4H	ROTEX SCREENER (2H)	2372	20915		BFG	——	VENDOR
	2	—	—	—	—	—	182	EX	BASE	COUP.	—	M-1/SE-9H	TK-1 BIN DUST COLLECTOR (1H)	2372	20891		VENDOR	VENDOR	——
	1/2	X	—	—	—	—	56	EX	GEAR	——		M-2/SE-9H	TK-1 BIN DUST COLLECTOR (1H)	2372	20891		VENDOR		
	2	—	—	—	—	—	182	EX	BASE	COUP.	—	M-1/SE-10H	TK-1 BIN DUST COLLECTOR (2H)	2372	20891		VENDOR	VENDOR	——
	1/2	X	—	—	—	—	56	EX	GEAR	——		M-2/SE-10H	TK-1 BIN DUST COLLECTOR (2H)	2372	20891		VENDOR		
	2	—	—	—	—	—	182	EX	BASE	COUP.	—	M-1/SE-11H	TK-2 BIN DUST COLLECTOR (1H)	2372	20891		VENDOR	VENDOR	——
	1/2	X	—	—	—	—	56	EX	GEAR	——		M-2/SE-11H	TK-2 BIN DUST COLLECTOR (1H)	2372	20891		VENDOR		
	2	—	—	—	—	—	182	EX	BASE	COUP.	—	M-1/SE-12H	TK-2 BIN DUST COLLECTOR (2H)	2372	20891		VENDOR	VENDOR	——
	1/2	X	—	—	—	—	56	EX	GEAR	——		M-2/SE-12H	TK-2 BIN DUST COLLECTOR (2H)	2372	20891		VENDOR		
	1/4	RT. ANG. DRIVE						EX	BASE	CHAIN		M-1/V-SP-3H		2372	21347		VENDOR	——	——
	1/4	RT. ANG. DRIVE						EX	BASE	CHAIN		M-1/V-SP-4H		2372	21347		VENDOR	——	——
	5	—	—	—	—	X	184T	EX	BASE	V-BELT	—	M-1/BL-1J		2373	21370		BFG	——	BFG
	3							EX	SL.BASE	V-BELT	—	M-BL-1/PK-1J	BAGGER BLOWER	2372	21420		VENDOR		VENDOR
	3							EX	SL.BASE	V-BELT	—	M-BL-2/PK-1J	BAGGER BLOWER	2372	21420		VENDOR	——	VENDOR
	15											M-1/CV-1J		2373	21423				
	75											M-1/CY-2J		2373	21423				
	1	—	—	—	X	—		EX		V-BELT		M-1/PK-2J	SCREW PACKER	2255	21418		VENDOR		VENDOR
	1/3	—	—	X	—					V-BELT		M-2/PK-2J	BAG SETTLER	2255	21418		VENDOR		VENDOR
	1 1/2	—	—	—	X	—	182T	EX				M-1/SCR-1J	ROTARY SIFTER	2373	21369		BFG		
	75											M-1/TK-1J		2373	21424				
	40											M-2/TK-1J		2373	21424				
	75											M-1/TK-2J							
	40											M-2/TK-2J							
	1/4	RT ANGLE DRIVE						EX	GEAR	D.S.V.O.		M-V-RY-1J	MICRO ROTARY AIR LOCK	2373	21371		VENDOR	——	——
	1/4	RT ANGLE DRIVE						EX	GEAR	D.S.V.O.		M-V-RY-2J	MICRO ROTARY AIR LOCK	2373	21371		VENDOR	——	——
												M-1/VSC-1J	VACUUM SYSTEM						
												M-BL-3/PK-1J							
	25	—	—	—	X	—	284T	EX	BASE	BELT		M-1/BL-1G	1ST STAGE INLET AIR BLOWER	2372	20965		BFG	——	VENDOR
	15	—	—	—	X	—	254T	EX		BELT		M-1/BL-2G	2ND STAGE EXHAUST BLOWER	2372	20964		BFG	——	VENDOR
	100	—	—	—	X	—	405T	TEFC	BASE	COUP.	—	M-1/BL-3G	1ST STAGE EXHAUST BLOWER	2372	20964		BFG	VENDOR	——
	20	—	—	—	—	X	256T	EX		BELT		M-1/BL-4G	COLD POWDER EXHAUST BLOWER	2372	20964	S-3366	BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-5G	TK-1G STORAGE BIN EXHAUSTER	2372	20965		BFG	——	VENDOR
	10	—	—	—	X	—	215T	EX		BELT		M-1/BL-6G	TK-2G STORAGE BIN EXHAUSTER	2372	20965		BFG	——	VENDOR
	75	—	—	—	X	—	444U	TEFC		BELT		M-1/CE-1G	DRYER "1G" CENTRIFUGE	2372	20706		BFG	——	VENDOR
Ⓑ	60	—	—	X	—	—	404TS	TEFC	BASE	COUP.	—	M-1/CM-1G	DRYING AIR BLOWER (1G)	2372	21057		BFG	VENDOR	——
	2	—	—	—	—	—	182	EX	BASE	COUP.		M-1/SE-5G	4E BIN DUST COLLECTOR	2372	20891		VENDOR	VENDOR	——
	1/2	—	—	—	—	—	56	EX	GEAR			M-2/SE-5G	4E BIN DUST COLLECTOR	2372	20891		VENDOR		
	2	—	—	—	—	—	182	EX	BASE	COUP.		M-1/SE-6G	4W BIN DUST COLLECTOR	2372	20891		VENDOR	VENDOR	
	1/2	—	—	—	—	—	56	EX	GEAR			M-2/SE-6G	4W BIN DUST COLLECTOR	2372	20891		VENDOR		
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-1G	ROTEX SCREENER	2372	20915		BFG	——	VENDOR
	2	—	—	—	X	—	184	EX	BASE	BELT		M-1/SCR-2G	ROTEX SCREENER	2372	20915		BFG	——	VENDOR
	3/4	45	GEARHEAD				56-S	TE 3V	SPECIAL	——	—	M-1/CV-2G	SCREW CONVEYOR	2372	21417		BFG	——	——
	3/4	45	GEARHEAD				56-S	TE 3V	SPECIAL	——	—	M-1/CV-3G	SCREW CONVEYOR	2372	21417		BFG	——	——
	3/4	45	GEARHEAD				56-S	TE 3V	SPECIAL	——	—	M-1/CV-4G	SCREW CONVEYOR	2372	21417		BFG	——	——
	3/4	45	GEARHEAD				56-S	TE 3V	SPECIAL	——	—	M-1/CV-5G	SCREW CONVEYOR	2372	21417		BFG	——	——

Ⓐ REVISION
ISSUED FOR CONSTRUCTION VBO 10-25-66
Ⓑ ADDED 60HP M-1/CM-1G KEE 11-15-66

REFERENCE DRAWINGS
GEN. ARR. ___
BILLS OF MAT'L ___
OPT. DRAWINGS G-10634, G-10635

DRAWN L.S. MOORE
APPROVED 11-1-66

MOTOR LIST FOR FLOW SHEET NOS. G, H, E, J
1966 COMPOUND AND RESIN EXPANSION
AVON LAKE GENERAL CHEMICAL PLANT

B.F.Goodrich Chemical Company
A Division of The B. F. Goodrich Company
3135 Euclid Avenue, Cleveland 15, Ohio

JOB NO. 5587-10558
E.A. NO. 54439

E-4290 REV B

(A) REVISION
ISSUED FOR CONSTRUCTION KDO 10-25-66 DFS 12-5-66
(B) ADDED H.P. TO PU-2S & PU-3S FYR 11-8-66 WWJ 11-14-66

MOTORS REQUIRED

H.P.	SP'L	900	1200	1800	3600	TYPE	SLIDE BASE	REQ'N	DELIVERY	REMARKS	H.P.	SP'L	900	1200	1800	3600	TYPE	SLIDE BASE	REQ'N	DELIVERY	REMARKS

MOTOR DISTRIBUTION

ITEM	HP	SP'L	900	1200	1800	3600	FRAME	TYPE	MOUNTING	DRIVE	SLIDE BASE	TAG NUMBER	APPLICATION	PLANT ORDER	EQUIP'T REQ'N	FOREIGN DWG.	MOTOR FURN BY	COUPLING FURN BY	SHEAVES & BELTS BY	REMARKS
												M-PU-* DRYER								
												M-PU-* POLY								
	3							EX	BASE	COUP.	—	M-PU-1S	FUEL OIL TRANSFER PUMP		21750		VENDOR	VENDOR		
(B)	7½					X						M-PU-2S	CONDENSATE RETURN PUMP		21623		VENDOR	VENDOR		
(B)	7½					X						M-PU-3S	CONDENSATE RETURN PUMP		21623		VENDOR	VENDOR		
	300	4160 VOLT					SPECIAL	ODP	FLANGE	DIRECT	—	M-1/CM-1U	FACTORY AIR COMPRESSOR	2363	20939		VENDOR	—	—	
												M-DR-1U	INSTUMENT AIR DRYER				VENDOR			
	1											M-1/PU-1U	CHEMICAL FEED PUMP				VENDOR			
110V	¼											M-1/PU-2U	CHEMICAL FEED				VENDOR			
	200	4160 VOLT			X	—		TEFC				M-1/PU-3U	SERVICE WATER PUMP	2361	20957		VENDOR			
	200	4160 VOLT			X	—		TEFC				M-1/PU-4U	SERVICE WATER PUMP	2361	20957		VENDOR			
	200	ELLIOTT 2 STAGE STEAM TURBINE					3560 RPM	200 P.S.I.			—	TU-1/PU-5U	SERVICE WATER TURBINE DRIVEN	2361	20957					
	40/10	—	X	—	X	—	365US	DPE	BASE	COUP.	—	M-1/WCT-1U	COOLING WATER TOWER BLOWER	2361	20807	F-8888	VENDOR			
	40/10	—	X	—	X	—	365US	DPE	BASE	COUP.	—	M-2/WCT-1U	COOLING WATER TOWER BLOWER	2361	20807	F-8888	VENDOR			
	⅓											M-AG-1/TK-1W	MIXER AGITATOR	2361	21108	S-4445	VENDOR			
	⅓											M-AG-1/TK-2W	MIXER AGITATOR	2361	21108	S-4445	VENDOR			
	⅓?											M-AG-1/TK-3W	MIXER AGITATOR	2361	21041		VENDOR			
	1				X							M-AG-1/WS-1W	PRECIPITATOR AGITATOR							FROM HENRY PLANT
	¼											M-PU-1/PU-1W	"FERRI-FLOC" PUMP	2361	21108	S-4445	VENDOR			
	¼											M-PU-1/PU-2W	"FERRI-FLOC" PUMP	2361	21108	9-4445	VENDOR			
	¼											M-PU-1/PU-3W	CAUSTIC PUMP	2361	21108	S-4445	VENDOR			
	¼											M-PU-1/PU-4W	CAUSTIC PUMP	2361	21108	S-4445	VENDOR			
	40	—	—	—	—	X	324TS	EX	BASE	COUP.	—	M-PU-1/PU-5W	CLARIFIER TRANSF. PUMP	2362	21329	S-4497	BFG	VENDOR	—	
	40	—	—	—	—	X	324TS	EX	BASE	COUP.	—	M-PU-1/PU-6W	CLARIFIER TRANSF. PUMP	2362	21329	S-4497	BFG	VENDOR	—	
												M-PU-1/PU-7W								
	5	—	—	—	—	X	184T	EX	BASE	COUP.	—	M-FIL-1W	PRECOAT PUMP	2374	21041		VENDOR	VENDOR	—	
	10	—	—	—	X	—	215T	EX	BASE	COUP.	—	M-1/PU-1X	TRANSFER PUMP D.M. WATER	2374	21126	S-4488	BFG.	VENDOR	—	
	10	—	—	—	X	—	215T	EX	BASE	COUP.	—	M-1/PU-2X	TRANSFER PUMP D.M. WATER	2374	21126	S-4488	BFG	VENDOR	—	
	20	—	—	—	—	X	A286UP	EX	FL	SPECIAL	—	M-1/PU-3X	HEADER PUMP	2374	21312	E-10134	VENDOR	—	—	
	[illegible]											M-1/PU-*	ACID PUMP							
	¾											M-1/PU-*	CAUSTIC PUMP							

REFERENCE DRAWINGS: G-1638, G-1640, G-1641, G-1642

L.E. MUNAL, 8-2-66, 8-24-66

AVON LAKE GENERAL CHEMICAL PLANT
1966 COMPOUND AND RESIN EXPANSION
MOTOR LIST FOR FLOWSHEET NOS. - "S" "U" "W" & "X"

B.F.Goodrich Chemical Company
A Division of The B.F. Goodrich Company
3135 EUCLID AVENUE, CLEVELAND 15, OHIO

JOB NO. 5667 — 10558
E.A. NO. 84439

E-4291 REV. B

EMZ

Distribution List and Numbers

BOOK No.	ASSIGNED TO:
1.	R. D. Scott - A. Vittone
2.	P. H. Lawrence
3.	J. L. Nelson
✓4.	W. E. Brodine
✓5.	W. F. Bixby
6.	G. H. Metzger
7. to 11.	O. F. Beckmeyer
12.	R. J. Wolf
13.	C. B. Cooper
14.	L. G. Crunkleton
15.	T. R. Linak
16.	A. R. Webber
17.	J. W. Goetsch

CONFIDENTIAL

COMPANY CONFIDENTIAL

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