W. G. KRUMMRICH PLANT

PROJECT PREMISES

TECHNICAL SERVICES DEPARTMENT

Title	MCS 1238 MANUFACTURING FACILITIES			
Dept.	Bldg.	Project No.	WorkOrder No's	T.S.D. Job No. Pg 1 of
246		8683		91370:4553
Misc Ident Data				Revision No. 3 Date November 1, 1975

Objective : To replace Aroclor 1016 with a non-PCB dielectric called MCS 1238 for capacitor use by modifying existing Aroclor 1242 manufacturing facilities.

TONE:

This project will allow for the replacement of Aroclor 1016 with MCS 1238 by using most of the equipment now used for Aroclor 1242 as well as Inerteen 54201 CM, a blend of 1242, and glycidylphenyl ether (PPO). No flexibility to return to Aroclor 1242 production is included.

The design is based on producing 12,000,000 lbs. per year of MCS 1238. However, capacity is now estimated at 8,000,000 lbs. per year until a second porocel column ($50,000) is included. Installation of a second porocel column is deferred until the capacity needs are realized by sales of MCS 1238.

Project completion is expected to be desired in the second quarter of 1976 using contract people. TSD will engineer this project; project engineering is anticipated to be 20 man-months.

Process development is such that some further refinements may be needed after the initial start-up. Up to six months of project follow-up may be necessary to define process variables and their effect. If blending the MCS 1238 mixture by tank level measurement becomes unacceptable, further capital expenditure will be required.

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Include as appropriate the following headings: 2. Dismantling and Retirements 3. Repairs 4. Other Expenses Also: PROCESS FEATURES; SAFETY FEATURES; BASIS OF ESTIMATE; CONSTRUCTION ITEMS; TENTATIVE PROJECT SCHEDULE

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PROCESS DEFINITION AND STATUS:

Design is based on discussion with J.G. Bryant in Research, as well as R&D Report P-1797 (not published), Process for Engineering Design for Blending and Refining on Non-PCB Dielectrics MCS 1475, 1588, 1238, dated June 19, 1975; a memo titled MIPB for MCS 1238, Sept. 16, 1975, to J.R. Savage from J.G. Bryant; and lastly, a memo titled Changes to MCS 1238 Project Scope, October 22, 1975, to participants from K.E. Boucher.

All the design data is not available. Raw material specifications are being developed; no MCS 1238 has been made using raw materials meeting the tentative specifications. TLV data is being determined by Industrial Biotest Laboratories. In conclusion, no complete R&D Tentative Process for design exists. Proposed specifications for MCS 1238, monoisopropyl-biphenyl (MIPB) and tolylxylyl sulfone (TXS) are attached.

PROCESS DESCRIPTION

MCS 1238 is a new non-PCB dielectric blend for capacitor customers. Monoisopropyl-biphenyl (MIPB), a low viscosity solvent, is mixed with tolyl xylyl sulfone (TXS), a high dielectric (DK) compound. The blend will be mixed to give a DK of 5 ± 0.075 at 100°C. Range of TXS needed is $23.8\% \pm 0.59\%$. The amounts of each component will be measured using a level gauge on the mix tank.

No refinement of TXS is required. An antioxidant, Ionol, will be added to unrefined MIPB prior to clay treatment using an attapulgus column.

The blend will be made by first pumping in the required volume of MIPB and holding it at 60-70°C. While circulating MIPB through an in-line mixer, TXS will be introduced. After adding TXS, the agitator will be turned on. The end of the blending period will be determined by an in-line DK analyzer readout.

The final MCS blend is further treated by passing it through a molecular sieve column and a porocel column. Additional Ionol may be added to the final product to prevent oxidation.

PROJECT RISK

1. Dixie is to supply the MIPB. It is not known if the proposed specification for biphenyl, water, and DIPB in MIPB will be consistently met. This project includes no facilities for changing the biphenyl, and DIPB content. Molecular sieve column is provided to remove water. The effect of varying DIPB content on blending of TXS with MIPB to achieve the correct DK is not known. Blending of the proper amounts of each raw material by tank level only is included.

2. The measurement of DK of the MCS 1238 before porocel treatment is subject to some error. This is because the resistivity may change upon porocel treatment. As a result some rework is possible that may reduce capacity and increase costs.

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PROJECT RISK (Continued)

3. The Crude 1142 will be further batch chlorinated to 1154 if there is insufficient column residue. The Crude 1142 containing some residual HCl and no lime will be transferred to #7 storage and then fed to the batch chlorinator. The #7 storage tank collects various fractions from throughout the Aroclor Department. At times some water is in these fractions. The combination of residual HCl and water may accelerate the corrosion of #7 storage tank. Most of the water comes from the off-gas collection system for the chlorinators. No method to remove this water is included in this project.

4. Some flexibility to rework MCS 1238 exists. More in-process storage would be desirable to provide minimum downtime. Additional storage tank for clay treated MIPB would reduce downtime. A surge tank for porocel treatment of MCS 1238 would also help reduce blending time and hold-ups.

   This project is necessarily limited to use of existing equipment due to limited time for construction.

5. The existing location (Track 11-4, 11-3) for unloading MIPB and loading MCS 1238 in tank cars can only receive tank cars less than 10,000 gallons in size.

6. MIPB is heat sensitive and can oxidize sufficiently so the electrical properties are out-of-specification. All steam tracers will be disconnected on process pipe lines with the exception of the TXS transfer line and pipe line from the blend tank to the porocel column. The MIPB temperature is raised to 60-70°C prior to clay treatment in an agitated vessel having an internal steam coil. As a precaution Ionol will be added before heating the MIPB to reduce the chance of oxidation at the higher process temperature. The system is nitrogen blanketed, of course, minimizing oxidation and excluding moisture.

DESCRIPTION OF PROJECT:

Process flow sheets and a block diagram is attached. The project, in brief, includes the following:

1. Installation of three new process pumps.

2. Level indication, temperature control, and nitrogen blanket for the steel TXS storage tank (1-230).

3. Installation of a level indicator and in-line mixer at the blend tank (1-178).

4. Level control for transferring Crude MIPB to the surge tank for clay treatment.

5. Tie in to existing piping and isolation of all piping from any Aroclor lines.

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DESCRIPTION OF PROJECT (Cont'd)

6. A separate N_2 supply to blanket all storage tanks.

7. Provision for drumming of MCS 1238. Later drumming is expected to be done at the Queeny Plant as production increases.

8. A concrete pad for unloading TXS trailers.

9. Use of Track 11 to load and unload MCS 1238 and MIPB in order to keep Track 10 only for Aroclor loading. Also safety showers at Track 10 & 11.

10. An Ionol addition system including a drum roller to disperse the Ionol crystals in MCS 1238 to make a concentrate, a weigh scale, and drum pump plus piping. Ionol concentrate will be added by weight to the finished goods tanks and the unrefined MIPB storage tank.

11. A 3 ft. dia. x 15 ft. high stainless steel molecular sieve column including structural steel and platform

AROCLOR EQUIPMENT USAGE:

The following equipment will be reserved for MCS 1238 service only. In addition, associated process piping will be dedicated for MCS 1238 service by physically being separated from any Aroclor process piping.

Item	Use
Track 11-3 Dock	Unload MIPB from 10,000 gallon or smaller tank cars.
1-329 #2 intermediate storage tank	Steel tank (20,000 gal.) for unrefined MIPB.
1-540, 1-537, #5 absorber, & #4 still surge tank	MIPB will be refined from the aluminum surge tank using the existing stainless steel porocel column (1-540) filled with attapulgus clay.
1-314 #17 storage tank	The 22,000 gallon aluminum tank to store refined MIPB.
1-178 #4 mix tank	This 304 ss 20,000 gallon tank equipped with an agitator will blend TXS and MIPB.
1-230 Rework tank	The 20,000 gallon steel tank will be used to unload trailers and drums of TXS.
1-561 #16 storage tanks	For MCS 1238 storage in 22,000 gallon aluminum tank.

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AROCLOR EQUIPMENT USAGE (Continued)

Item	Use
1-118 #10 storage tank	For MCS 1238 storage in 22,000 gallon aluminum tank (both 1-561 and 1-118 can store MCS 1238 to be reworked by pumping back to the #4 mix tank 1-178.)
1-545 #4 absorber	For porocel treatment of MCS 1238.
Track 11-4 Loading MCS 1238	MCS 1238 will be loaded into 10,000 gallon or smaller tank cars or drummed.
1-179 #4 mix tank pump	Transfer pump on #4 mix tank will be replaced with a larger stainless steel unit to overcome pressure drop through porocel column and pre-filter.
1-232 Rework tank pump	Non-standard pump will be replaced with a Durco Mark II unit at the rework tank.
New pump #2 intermediate tank	A new transfer pump at #2 storage tank will be purchased. Existing pump (1-330) will be reserved as a spare for feeding the Aroclor column for MCS 1016 production.
In-line mixer at #4 mix tank	A stainless steel 3" pipeline mixer for introducing the viscous TXS into the MIPB will be purchased for #4 mix tank.
New Absorber 1-539	3 ft. dia. x 15 ft. high stainless steel molecular column.
1-551	Ionol drum roller to mix concentrate
1-552	Ionol weigh scale to meter Ionol addition.
1-553	Ionol drum pump to transfer concentrate to finished goods tanks and unrefined MIPB storage.

New Major Instrumentation (Critical Items)

Item	Use
DK analyzer at #4 mix tank, field mounted	Unit to be purchased will consist of an in-line capacitance probe with temperature controlled. This DK unit is for determining when blending has been completed; is not to accurately determine DK. DK will be checked by the laboratory prior to porocel treatment.

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AROCLOR EQUIPMENT USAGE (Cont'd)

New Major Instrumentation (Cont'd)

Item	Use
Level indicator on #4 mix tank	A Varec level gauge will be used on #4 mix tank.
Temperature control on rework tank.	A field unit to hold TXS at 70-90°C will be used. TXS is high viscous at lower temperatures.
Level indicator on rework tank.	A field mounted d/p unit will be used on the rework tank for level measurement.

Utilities and Services

Nitrogen blanket system	A separate N_2 supply system will be installed for all storage equipment in MCS 1238 service. Nitrogen is needed to keep all raw materials and product dry. The separate system is required to avoid PCB contamination.

ENVIRONMENTAL AND SAFETY

A Safety and Environmental review was held. More toxicity data requested. Safety showers will be located at the MIPB, TXS and MCS 1238 loading docks. Remote pump push buttons will be required at the MCS loading dock and at #4 Mix Tank. The attapulgus clay and porocel will be landfilled, frequency of once per year or less. The molecular sieves may be dumped every 2-6 months. Special precautions are necessary to handle molecular sieve containers because of its alkalinity.

ESTIMATE OF EXPENDITURE, ALTERNATIVES

Project cost is estimated at $450,000 capital and $100,000 expense. The capital estimate includes 13% for engineering and 20% for contingencies. The expense includes $60,000 contingency for possible repairs to tracing and insulation on existing idle pipelines to be used for this project.

Management was presented with several alternatives. This project calls for attapulgus clay, porocel and molecular sieve treatment, blending and storage. Ionol addition is included to prevent oxidation.

The cycle time for blending 16,000 gallons is about 75 hours; some 25 hours can be eliminated if a second porocel absorber is installed. If production capacity needs to be increased above 8,000,000 lbs. per year a second absorber may be installed in the future.

ESTIMATE OF EXPENDITURE, ALTERNATIVES (Cont'd)

Capacity:

Assuming a 75 hour blend cycle with an 16,000 gallon batch, capacity with 5 days, 3 shifts per day is calculated below:

Cycle at #4 Mix Tank:

Charge raw material	5 hours
Mix	5 "
Lab analysis	2 "
Adjust	5 "
Dry	8 "
Porocel treat	50 "
Total cycle	75 hours

Capacity per hour:

$$\frac{16{,}000 \text{ gallons} \times 8.25\#/\text{gallon}}{75 \text{ hours}} = 1760 \text{ lbs/hour}$$

Monthly capacity:

(22 days/month; 75% ost.)

22 days x 24 hrs/day x .75 x 1760 lbs/hr = 696,960 lbs/month

Timing:

A schedule to meet a May 1, 1976, targeted completion date is given. Construction will be by contractor on a time and material basis. Early project approval is essential.

Pre-project approval: $30,000 engineering, $30,000 equipment	11/7/75
Appropriation Request Estimate Approval	12/1/75
Design package	1/1/76
Begin construction	1/1/76
Make tie-in (stop Aroclor 1242 production)	2/15/76
Begin equipment cleanout	4/15/76
Complete construction and check out and begin start-up	5/1/76

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Timing (Cont'd)

The early start-up does assume some PCB's will be in the initial MCS 1238 made. Otherwise, more extensive clean-out would be required. No extensive utility shutdown for tie-ins are expected.

Production Manpower:

Initially no increase in production manpower will be needed. Normal schedule will be 5 days per week. 3 shifts per day. When full production is required, manpower could be increased by two men.

Kenneth E. Boucher
Technical Services Department

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APPROVALS:	DATE
W.C. Engman, TSD Supt.	
G.J. Geers, Maint. Supt.	
G.L. Johnson, Prod. Supv.	
A.E. Leisy, Gen. Supt.	
W.C. Hammann, Research Mgr.	
C.P. Orr, Engineering Mgr.	
R.A. Pohl, Mfg. Mgr.	

Distribution:

J.G. Bryant - G.O.
C.F. Buckley
W.P. Conant
R.J. Crump
N.L. Davis - JFQ
C.N. Deubner
W.C. Engman
G.J. Geers
J.F. Halla
R.L. Harness
R.L. Heider
H.J. Horner
O.K. Hotto
G.L. Johnson
R.M. Kountz - G.O.
A.E. Leisy
D.K. Lynch
T.M. Morrow
C.P. Orr - G.O.
R.A. Pohl - G.O.
W.L. Smull
L.W. Sprandel
G.W. Watson
C.W. Wehking
W.C. Hammann - G.O.

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APPENDIX

TENTATIVE SPECIFICATION FOR MIPB

PROPERTY	LIMIT	METHOD
DIPB Content	22.5-27.5%	GLC
Biphenyl (max.)	0.05%	GLC
Moisture (max.)	30 PPM	Aqua Test II
Color (max.)	10	APHA

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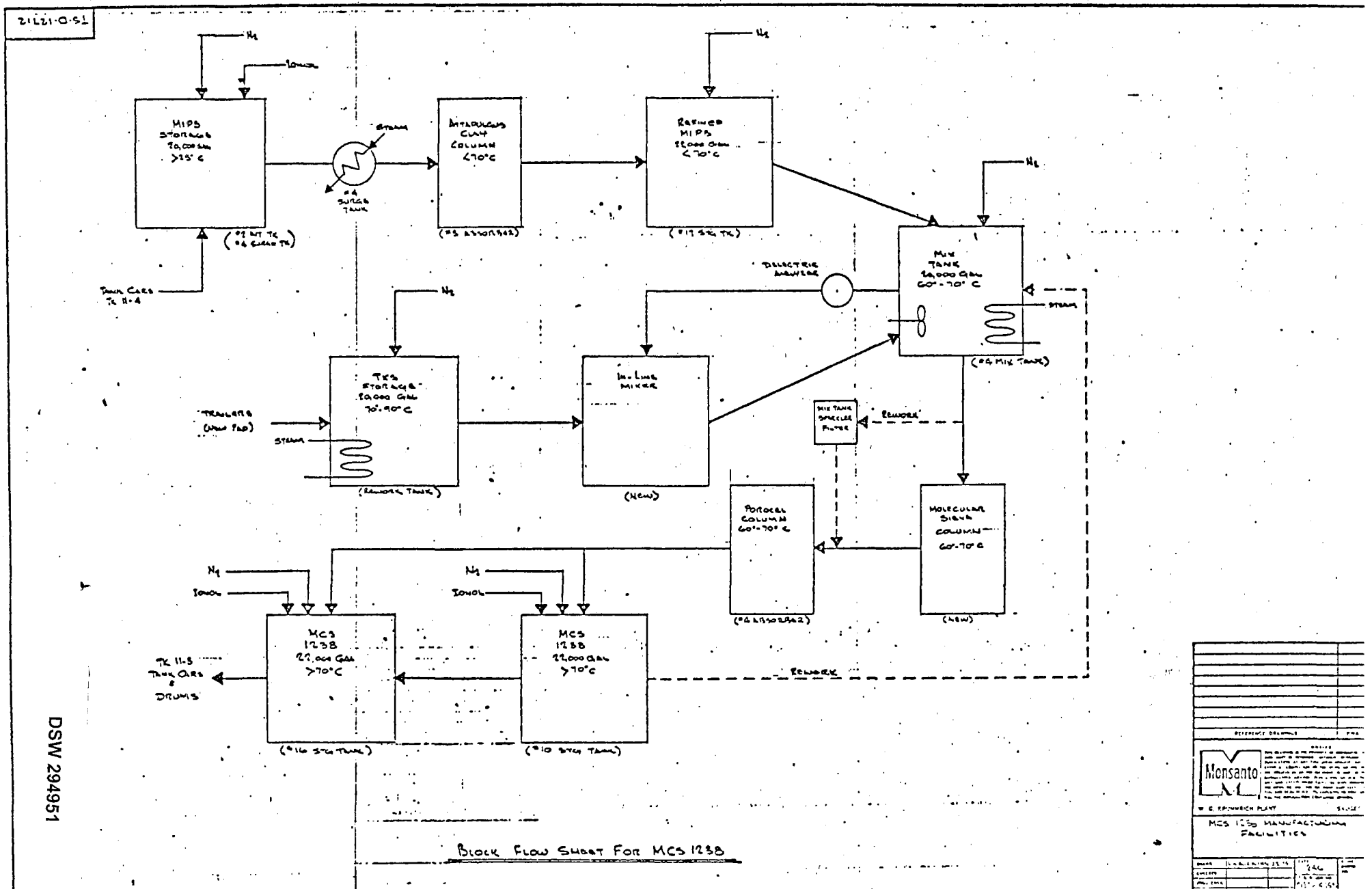

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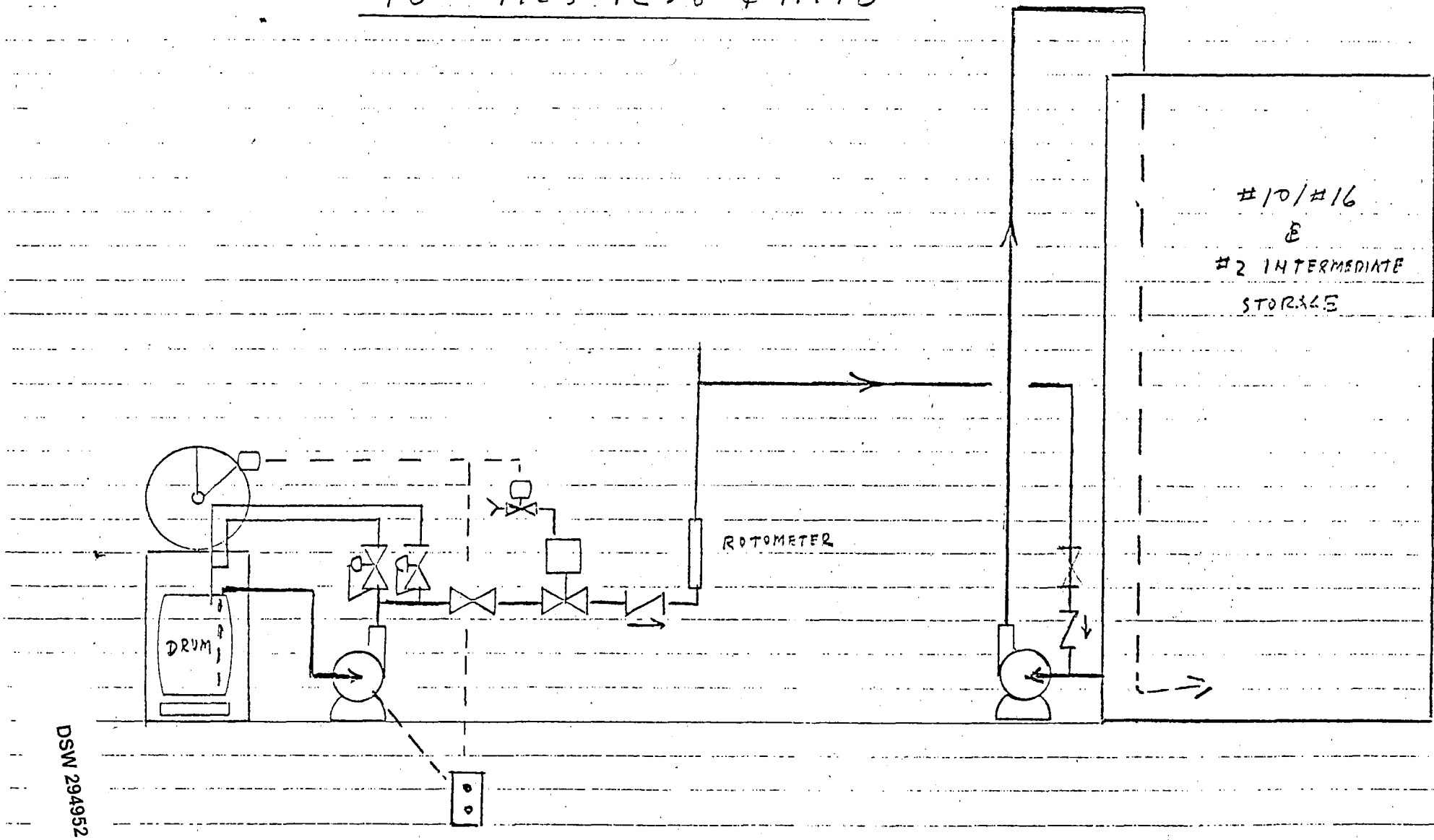
IONOL SYSTEM OF ADDITION

TO MCS 1238 & M1PB



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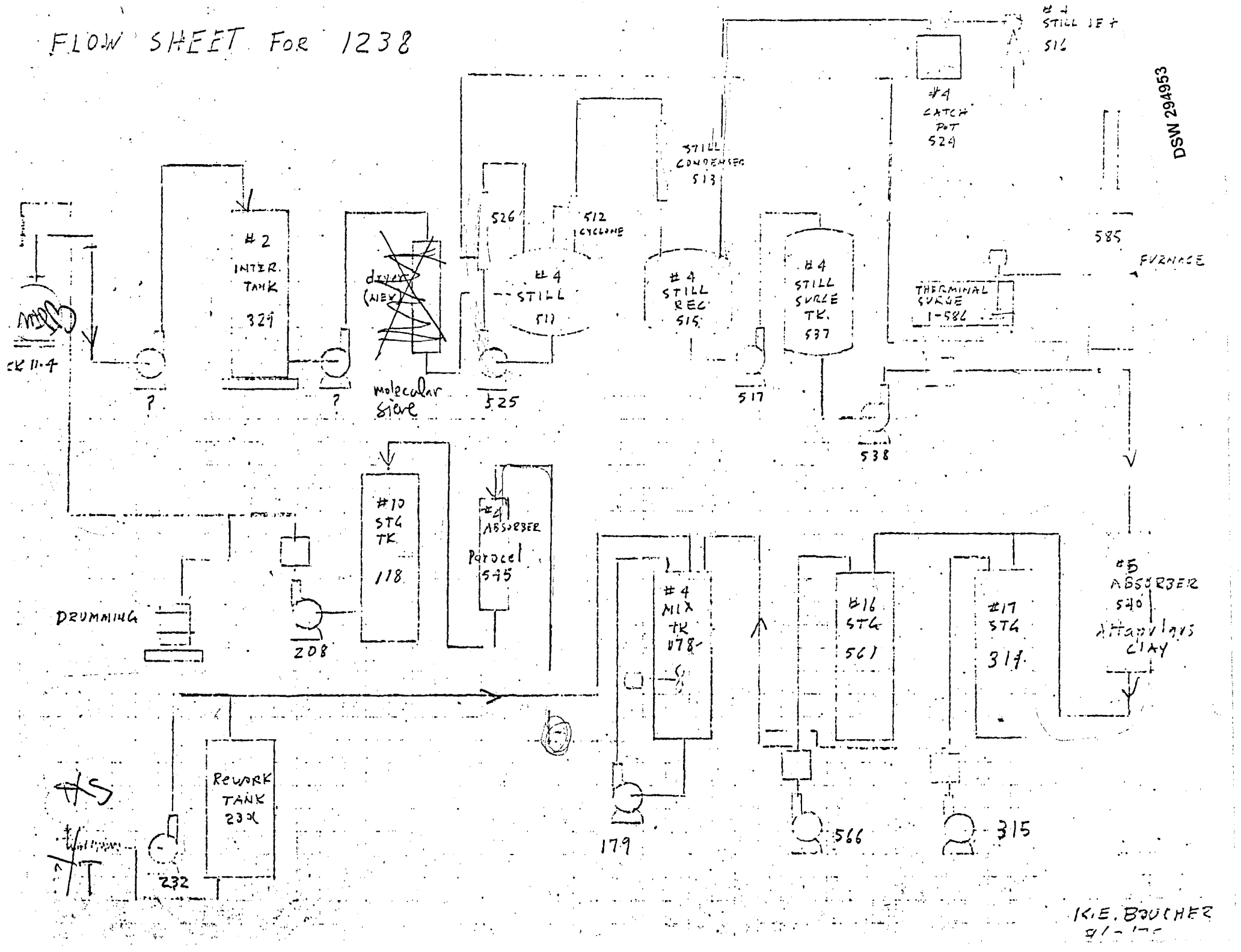

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SHEET #1
9/8/75

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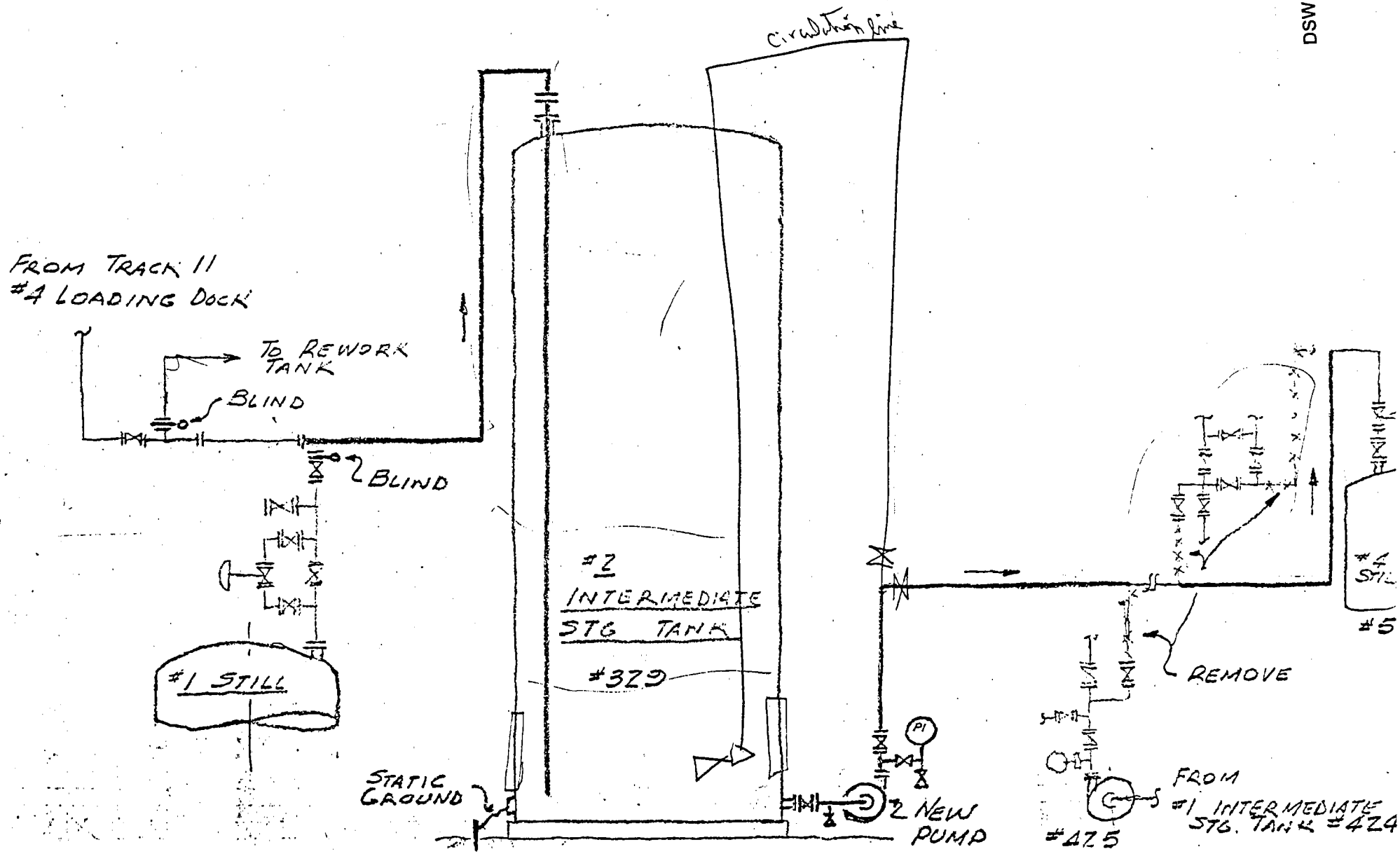

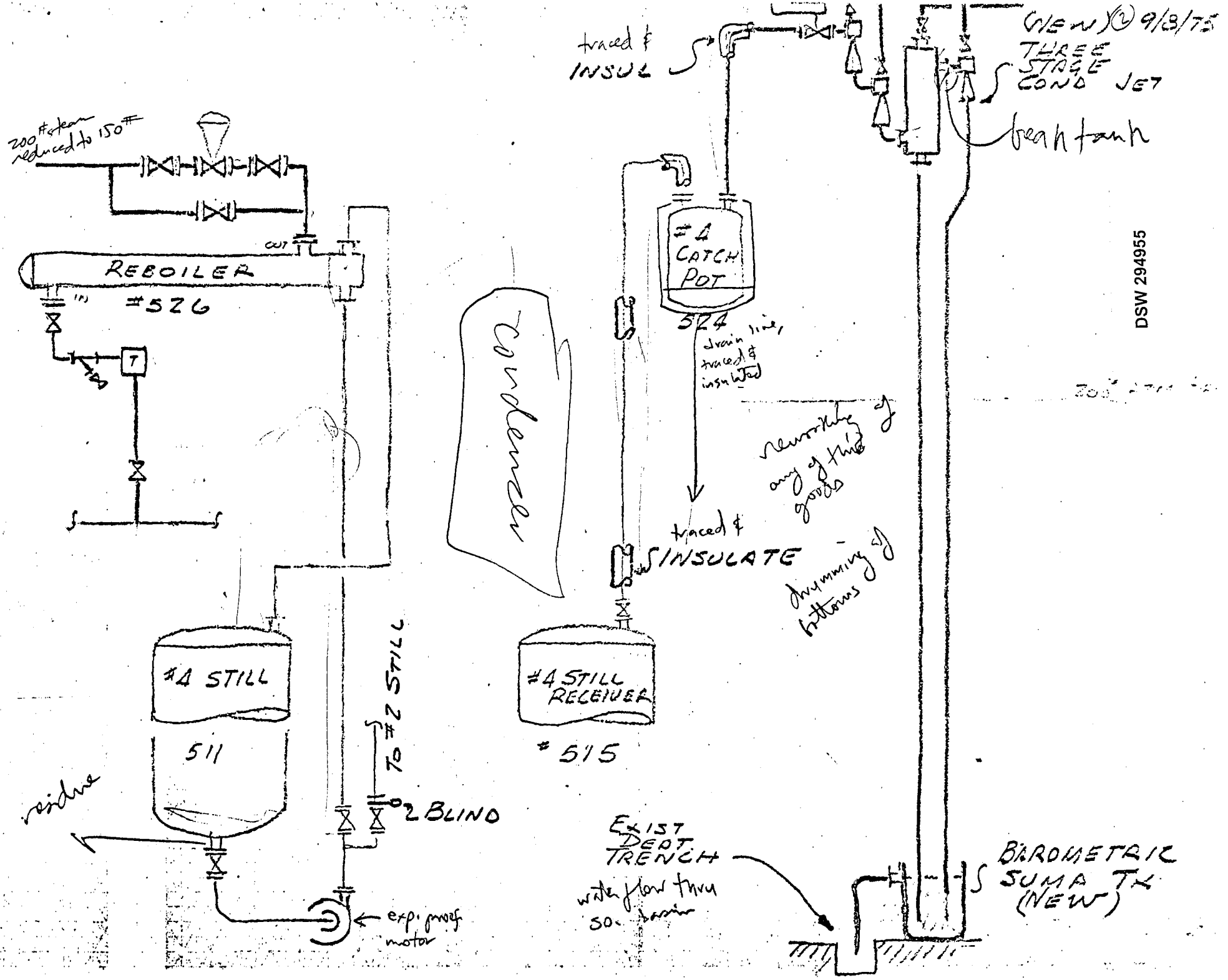

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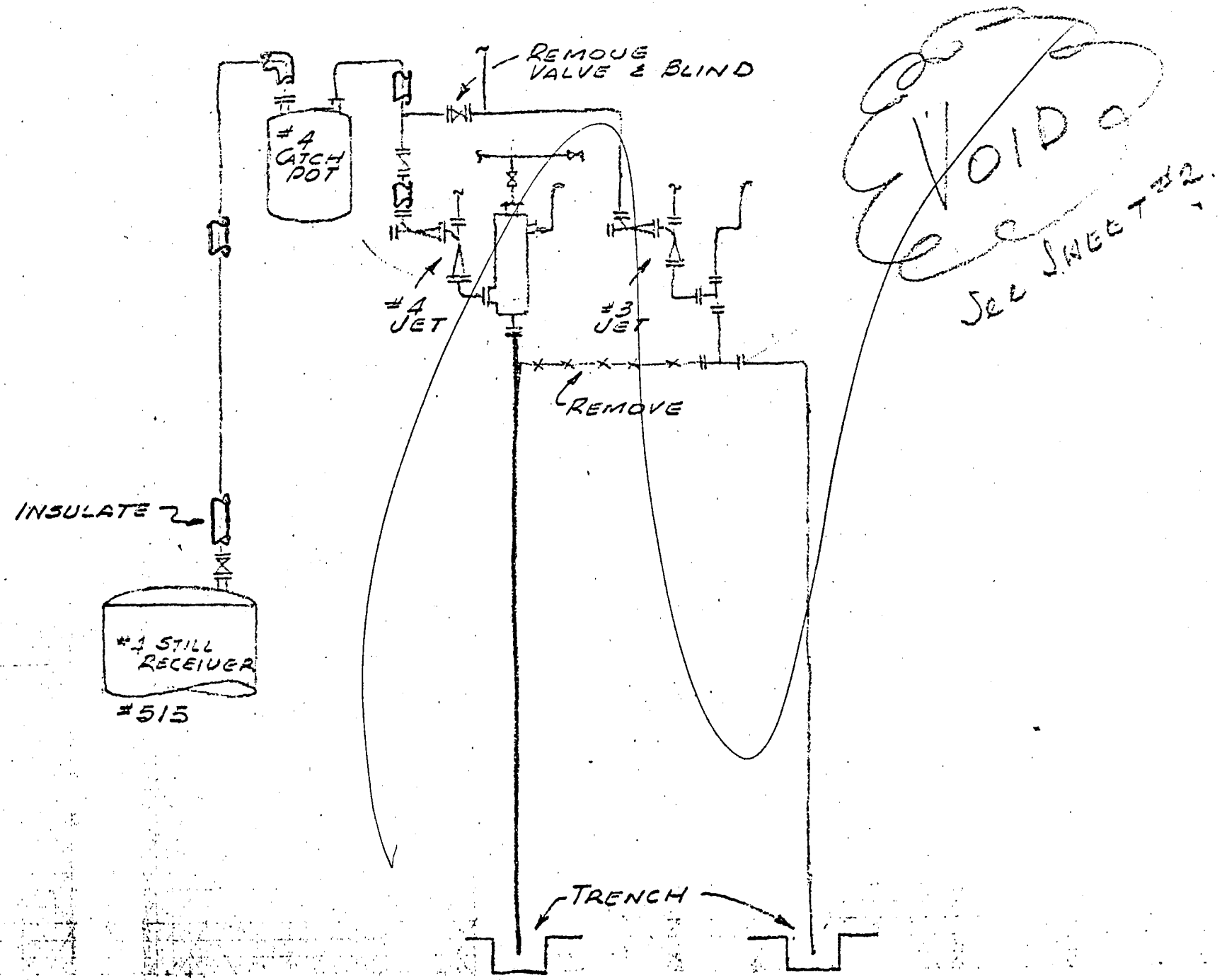
SHEET - 4.1
5/8/75



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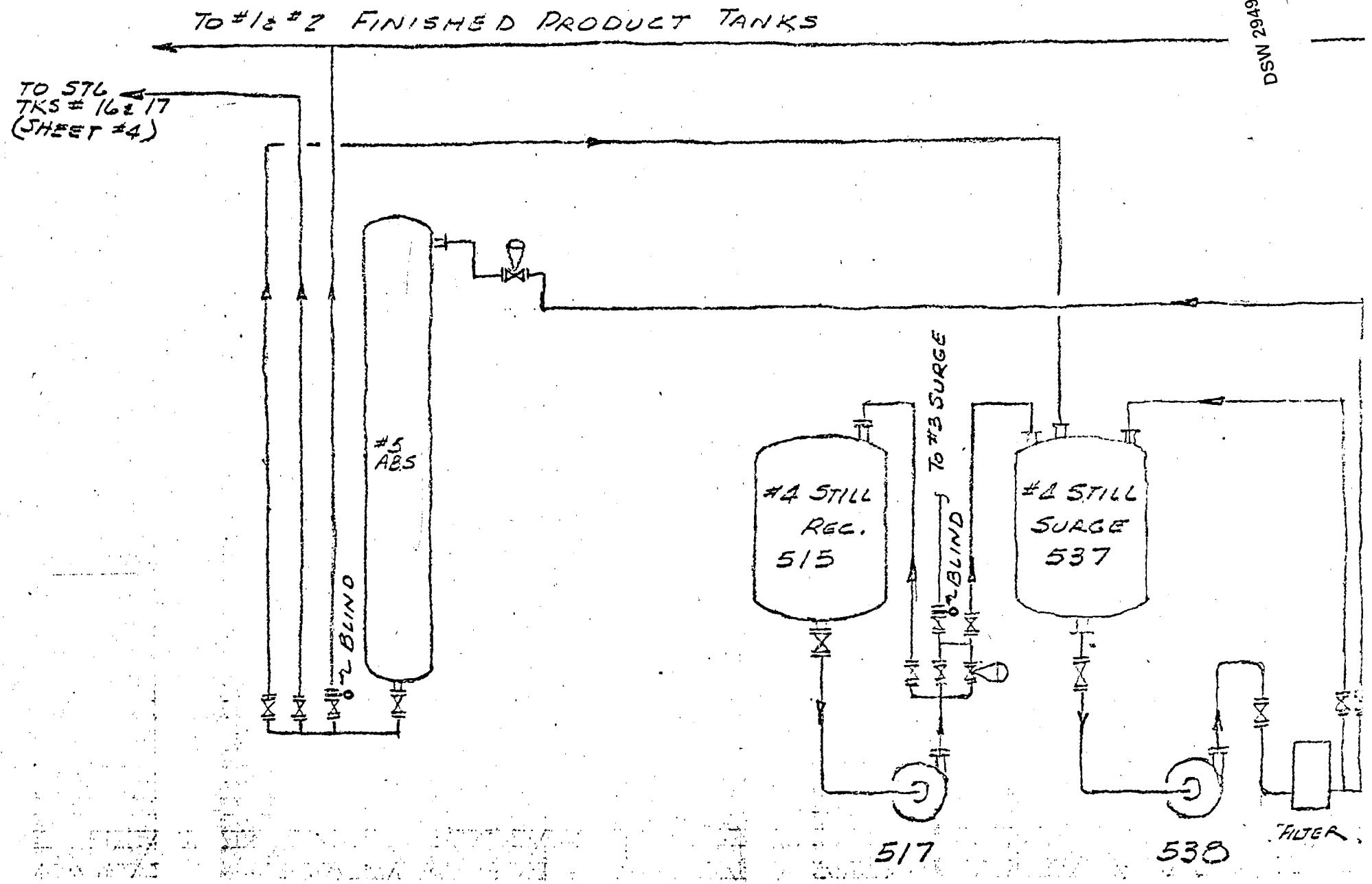
SHEET -3
9/8/75



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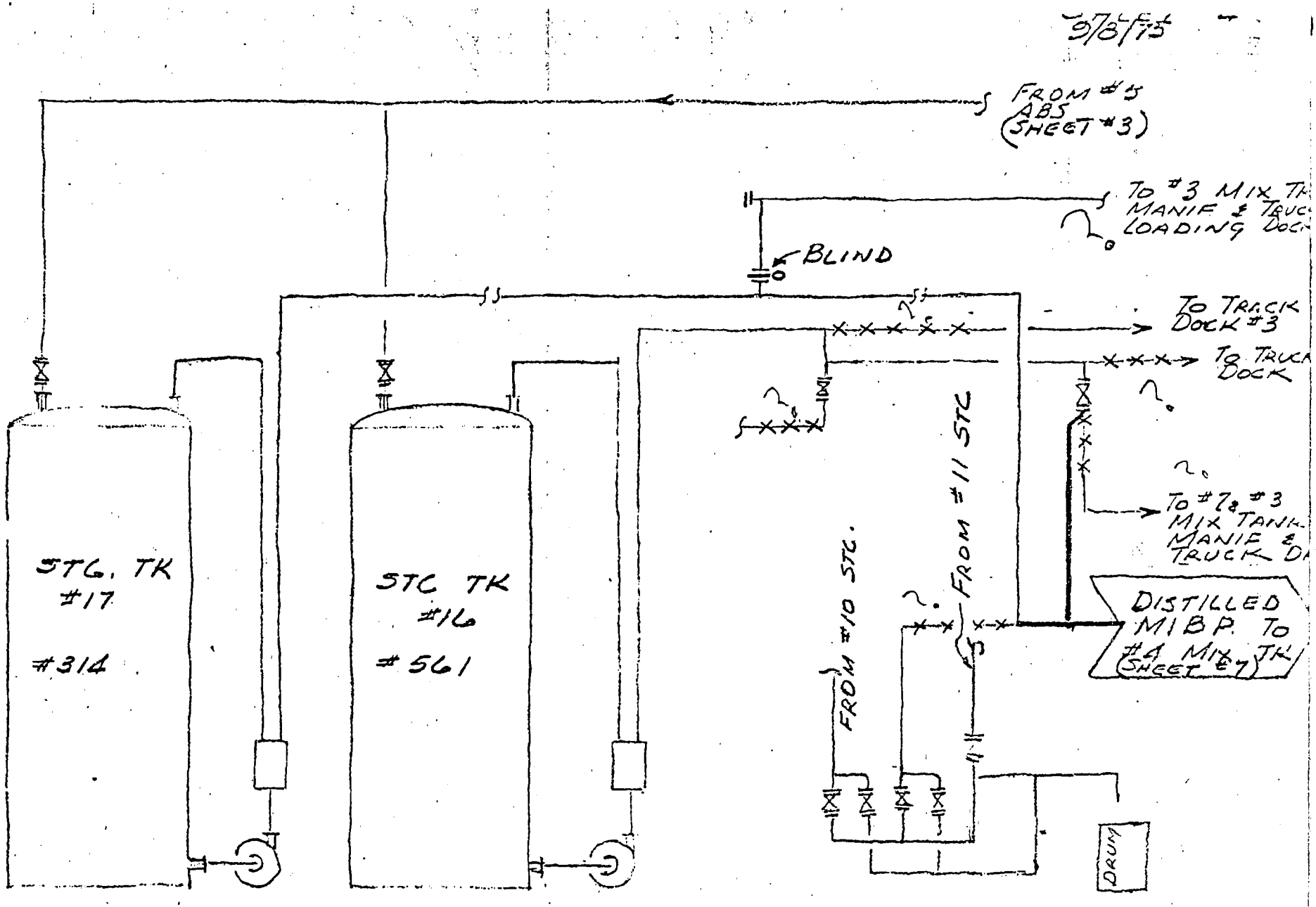

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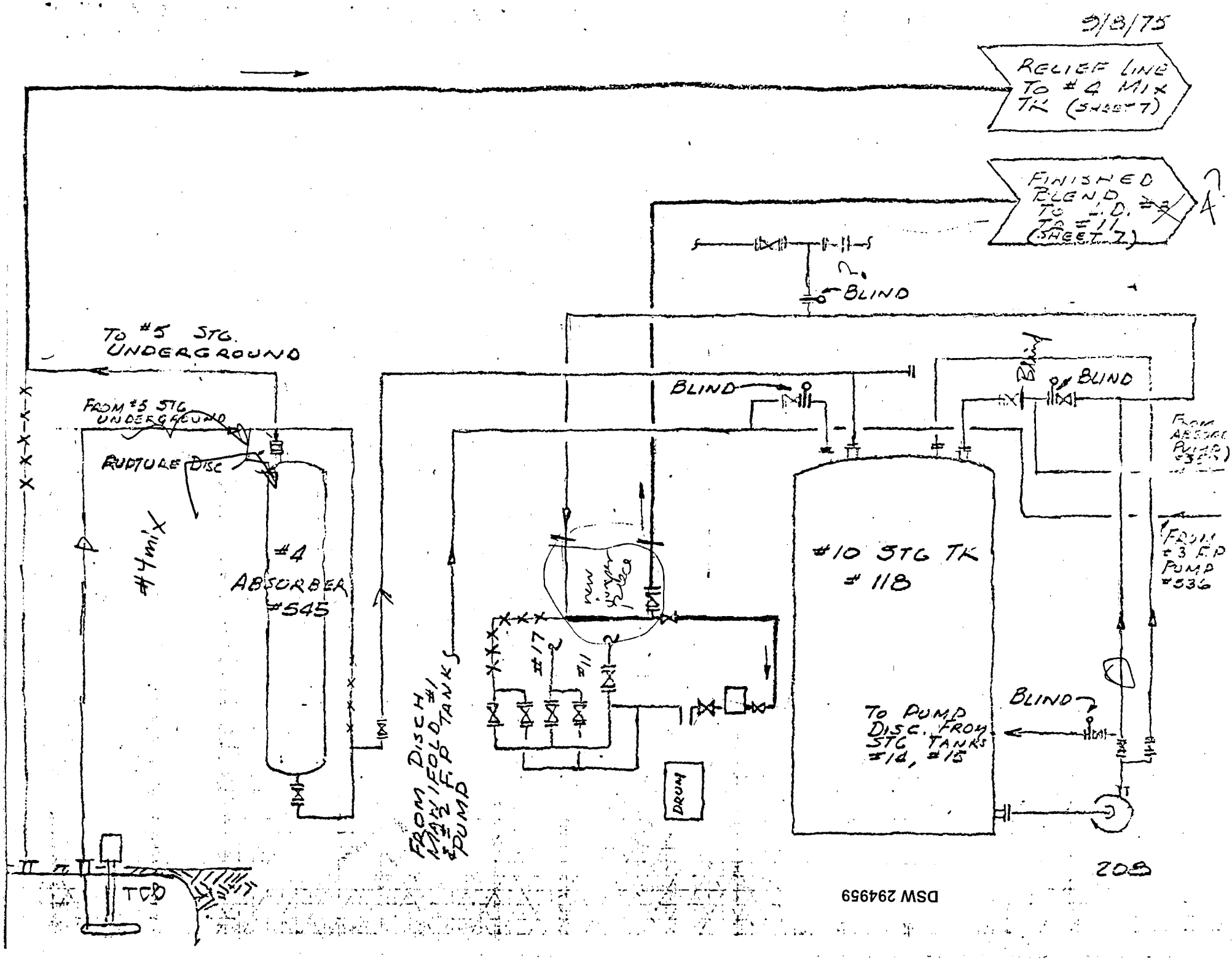

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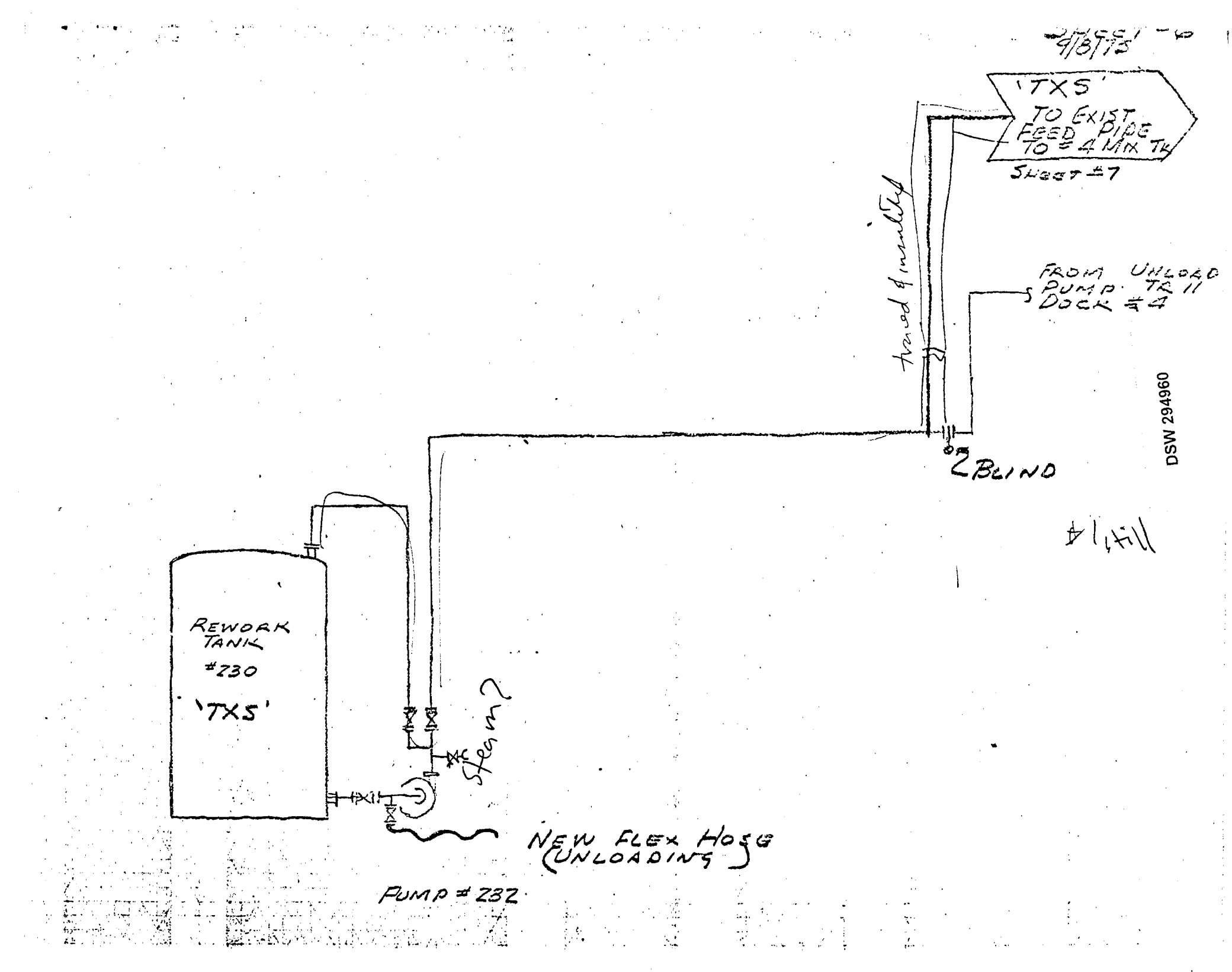

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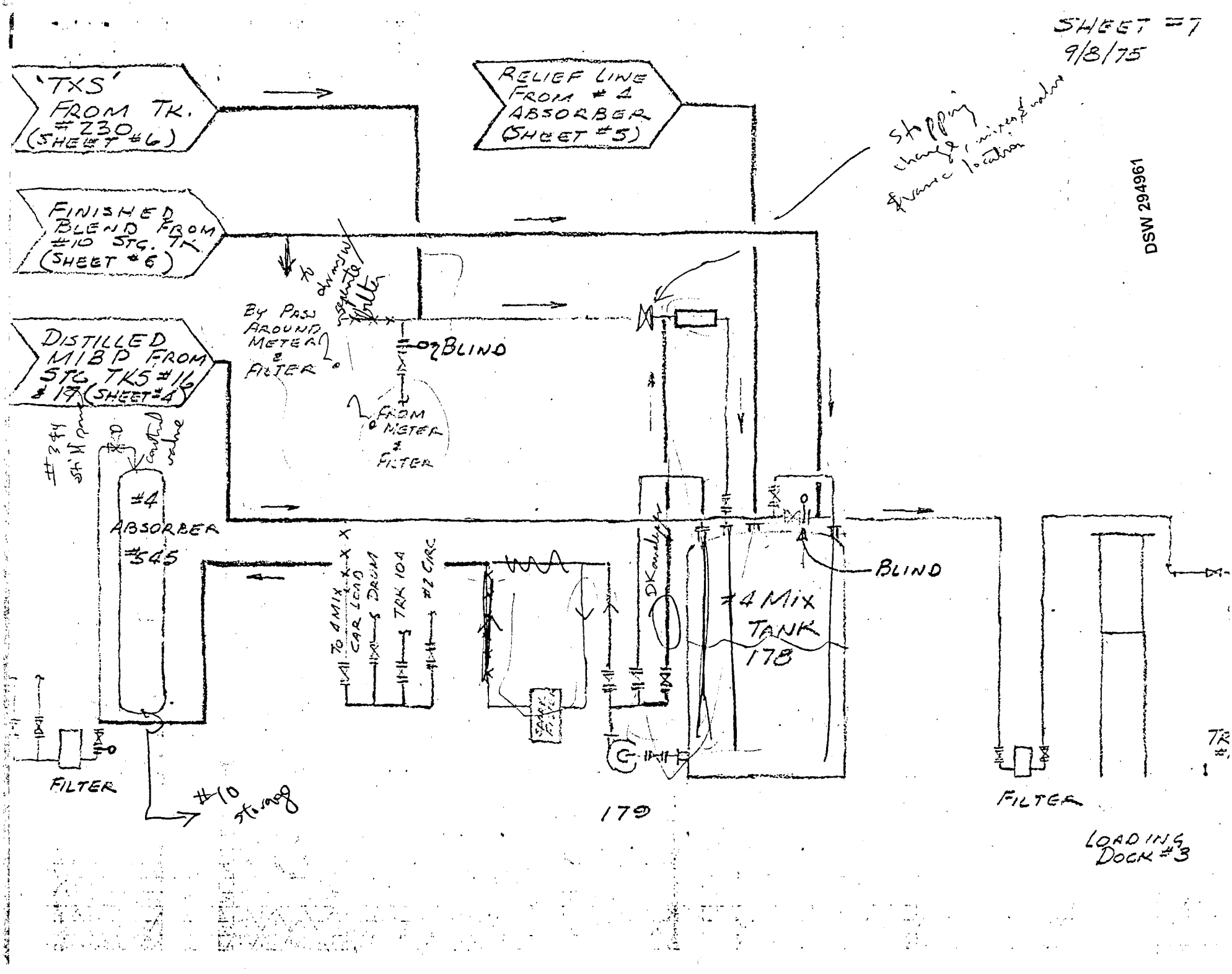
SHEET #7
9/8/75
'TXS' FROM TK. #230 (SHEET #6)
RELIEF LINE FROM #4 ABSORBER (SHEET #5)
FINISHED BLEND FROM #10 STG. TK (SHEET #6)
DISTILLED MIBP FROM STG TKS #16 & 17 (SHEET #4)
BY PASS AROUND METER & FILTER
BLIND
FROM METER & FILTER
#4 ABSORBER #545
TO 4 MIX CAR LOAD
DRAIN
TRK 104
#2 CIRC
#4 MIX TANK 178
BLIND
FILTER
#10 storage
179
FILTER
LOADING DOCK #3
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STLCOPCB4065476

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POTENTIAL RISKS	APPROACH
1. Handling viscous TXS	1. Trace lines and insulate. Provide steam supply at trailer pad. Agitate tank with eductor and temp. control. Trailer pad sumped.
2. Temperature sensitivity of MIPB.	2. Limited steam tracing of lines/none for MIPB. Automatic cut-off of steam in molecular sieve. Ionol addition to MIPB. N_2 blanket. Blow-outs for transfer lines where traced. Special instructions in blend tanks.
3. Moisture in raw materials.	3. Molecular sieve column. Control analysis/specification on R.M. N_2 blanket.
4. Blending to proper DK by volume.	4. Large batch. Addition by volume/no agitation. Temperature control of TXS. In-line-DK analyzer
5. Constant raw materials	5. New specifications
6. Molecular sieve alkalinity	6. Safety shower and eye bath. Platform/pad. Hot water source.
7. Addition of Ionol	7. Addition of 10% concentrate by weight. Agitate storage by eductors. Exclude air.
8. Pressure drop through Porocel column.	8. Keep MCS 1238 60-70°C to lower viscosity. Trace MCS 1238 line to porocel column. High pressure pump.
9. Dispersion of TXS in MIPB.	9. In-line-mixer. Flow control of TXS. Control shut-off with reverse flow.
10. Insufficient in-process storage.	10. Two finished product tanks. Piping for rework/filter. Long blending cycle as a result.
11. Rework	11. Sparkler filter. Return finished goods to blend tank. Two finished goods tanks.
12. Moisture in product.	12. Can return to blend tank and molecular sieve.
13. Operation based on 5 days.	13. Limited by porocel column.
14. Clean out	14. Recognize first product will have some PCB's. Change-out porocel column.
15. Contamination	15. Separate N_2 system. Isolate process piping and equipment.
16. Sewer Losses	16. Did not install new side entering agitators. Questioned if MCS 1238 will increase PCB losses.
17. Safety	17. Safety shower at loading dock for MCS 1238, TXS trailer pad and molecular sieve column.

POTENTIAL RISKS	APPROACH
18. Landfilling	18. Will need leach tests.
19. Heating MIPB/Overheating TXS	19. Minimized steam pressure at TXS tank and #4 surge tank. Add Ionol at MIPB storage. Turn off steam when possible. Used eductors or agitators to reduce skin temperature.

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