Interoffice Communication

To Distribution

From R. J. Mehring, Ponca City

Date September 16, 1982

Subject LINE SCHEDULE SPECIFICATION

Attached is a copy of a new Line Schedule Specification, together with it's companion Line Schedule Sheet (Form 4-788S), for your consideration and use.

This material is the culmination of review and consideration of various engineering contractor documents, the existing Process Piping Schedule (PED), and comments from representatives of both PED and CED.

The information to be furnished by the process designer encourages evaluation of various limiting conditions to which each line may be subjected. This, in turn, provides the mechanical designer with sufficient and uniform data to assure compliance with the applicable piping code, as well as any additional Conoco requirements. The completed form will serve as an excellent record for each project, however large or small.

Copies of the Line Schedule Sheet (Form 4-788S) may be obtained from the Printing and Distribution Department, Ponca City.

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att
Distribution:
All Plant Managers
PED
CED

Conoco Inc.

LINE SCHEDULE SPECIFICATION

1. SCOPE

This specification is the line index for all numbered lines shown on the P&I Diagrams. It provides information for the design, materials identification, and testing of each line in the piping system.

2. CODES

The design temperature and pressure, wall thickness, and minimum test pressure shall, as a minimum, meet the requirements of the Chemical Plant and Petroleum Refinery Piping Code, ANSI/ASME B31.3, and where applicable, the Power Piping Code, ANSI/ASME B31.1.

3. FLUID SYMBOLS

The fluid service of each line shall be designated by a letter group, such as listed below. Additional fluid services, as required by the project, shall be assigned similar letter groups by addendum to this specification. Piping attached to a vessel, such as an instrument bridle, is identified as vessel trim by the Letter Group VT.

Air	
Instrument	AI
Process	AP
Utility	AU
Alum	AL
Condensate (Nominal)	
Vacuum	CV
Low Press (up to 150 psig)	CL
Med Press (141 to 400 psig)	CM
Hi Press (above 400 psig)	CH
Contaminated (Sour)	CC
Blowdown	CB
Fuel	
Oil	FO
Gas	FG
Fluidized Solid Materials	
Aluminum	BA
Coal	BB
Catalyst	BC
Dry Chemical	BE

Hydrocarbons	
Crude Oil	HC
Hydrogen 75 psia pp or greater	HH
LPG or Light Vapor	HL
Miscellaneous	HM
Naphtha	HN
Middle Distillate	HD
Residual	HR
With H_2S 100 ppm or greater	HS
Inert Gas	
Nitrogen	IN
Carbon Dioxide	IC
95% N_2 + 5% Lt. Hydrocarbons	NH
Sewers (Drains)	
Chemical	DC
Oily Water	DO
Storm Water	DS
Sanitary	DY
Misc. (Sludge-Solids)	DM

Steam (Nominal)	
Vacuum	SV
Exhaust (up to 50 psig)	SE
Low Press (51 to 150 psig)	SL
Med Press (151 to 400 psig)	SM
Hi Press (Above 400 psig)	SH
Sulfur, Liquid	SU
Water	
Boiler Feed	WB
Cooling-Supply	WC
Cooling-Return	WH
Sea	WO
Phosphate Solution (Process Water)	WP
Raw	WR
Potable	WD
Treated (Demin., Deion., Dist.)	WT
Utility	WU
Fire	WF
Sour	WW
Quench	WQ
Wash	WX

Acid-Basic-Toxic	
Amine (DEA-MEA-TEA)	XA
Chlorine	XC
Hydrochloric	XH
Neutralized Effluent	XE
Hydrofluoric	XF
Nitric	XN
Sodium Hydroxide (Caustic)	XO
Sulfuric	XS
Pyrophoric	XP
Toxic Non HC Vapor	XV
Lead Alkyls (TEL, TML, etc.)	XL
Ammonia Hydroxide	XM
Manganese Additive (MMT)	XT
Chemical Additives/Corrosion Inhib.	XX
All Services	
Blowdown and Relief	BD
Flare High Press. ($>$ 30 psig)	FH
Flare Low Press. ($\leq$ 30 psig)	FL
Vessel Trim	VT
Breather Vent	BV

4. **LINE NUMBER**

Numbers are assigned to each line starting, for example, with Number 100 sequentially through 999 for each fluid symbol. The line number is prefixed with the unit number. Lines going from one unit to another shall carry the originating unit number. Another method of line numbering combines the section number with the line number, using four digits. For example, in Section 200, the first line number is 2001 sequentially through 2999 for each fluid symbol. See paragraph 17 for a description of a composite line designation.

A line shall be defined as the connecting pipe serving a common process function between two or more pieces of equipment; between a header (e.g. main distribution or collection) and a piece of equipment; or between two lines. A header shall be considered the same numbered line throughout its entire length even though its nominal size may change. Small take-off piping such as vents or drains (except to closed systems), or to instruments, hose stations, safety showers, and eyewash stations shall be included as part of the designated line.

5. MATERIAL CLASS

Piping Material Classes are assigned for various services. Normally only one material class is assigned for each line number. A designated material class is prefixed by a specific pressure class. Refer to the Piping Material Specifications for the Class Symbols.

6. LINE SIZE

The major pipe sizes for each line shall be listed. All sizes requiring pipewall thickness calculations shall be listed.

7. FLUID

The type of fluid shall be indicated as liquid, vapor, liquid/vapor, or fluidized solids. This information is required for orientation of instrument connections and for pipe stress analysis.

8. TEMPERATURES AND PRESSURES

Unless otherwise noted, temperatures shall be fluid temperatures expressed in degrees fahrenheit. Pressures are normally internal, including fluid head, and shall be expressed in lb/in^2 gauge.

a. Normal Operating Conditions. The process conditions of greatest severity expected during normal operation. Conditions such as turndown, start-up, dual-cycle, and regeneration shall be included, when appropriate, as separate entries.

b. Short Term Variations. Variations in temperature, pressure, or both, from normal operating conditions are characteristic of certain services. These conditions are determined, for example, from safety relief valve operation, equipment failure (including control valves), misoperation (including loss of cooling medium), pump shutoff conditions, steamout, and purging.

c. Design Temperature and Pressure. The conditions listed shall be set by consideration of the normal operating conditions, short term variations, and the applicable code requirements. The piping system shall be designed for the most severe coincident temperature and pressure for the condition requiring the greatest pipewall thickness and the highest flange rating.

   See Appendix to this specification for a selection procedure, with examples, in determining the most severe coincident temperature and pressure.

d. Code Allowance. The ANSI/ASME B31.3 allowances for variation from normal operating conditions given in 302.2.4 shall not be permitted.

9. **STRESS ANALYSIS**

Initial need for stress analysis shall be determined from criteria given in Conoco Engineering Standard A-25. Final determination for stress analysis shall be made by the responsible engineer when reviewing the piping system isometric drawings. When a formal stress analysis is required, the responsible engineer shall determine the maximum design temperature, T_{max}, and the minimum design temperature, T_{min}, in accordance with the rules of 319.3.1, ANSI/ASME B31.3.

10. **CORROSION ALLOWANCE**

The required corrosion allowance shall be specified. Normally, the required corrosion allowance for each piping material class is given in the piping material specification.

11. **SCHEDULE OR WALL**

The wall thickness listed may be obtained from the piping material specifications, or by calculation. The thickness shall be based upon the design temperature and pressure, including required corrosion allowance, mill tolerance, and mechanical allowances, such as thread depth. The resultant thickness shall be increased to the nearest commercially available thickness.

12. **MINIMUM TEST PRESSURES**

Test Pressures are normally hydrostatic, and shall be determined by the applicable code. Field testing of piping systems, including associated equipment, shall utilize common test pressures insofar as practicable, without exceeding the yield strength criteria given in the applicable code.

13. **INSULATION TYPE**

The purpose for insulating, including any external heating requirements, is designated by a letter symbol as listed below. The holding temperature for external heating shall be listed in the remarks column.

N--No Insulation
P--Personnel Protection
H--Heat Conservation
C--Condensation Control
E--Electric Traced and Insulated
W--Hot Water Traced and Insulated
A--Acoustic
B--Hot Service and Acoustic Insulated
K--Steam Traced and Acoustic Insulated

J--Steam Jacketed
S--Steam Traced and Insulated
D--Dual Temperature
L--Cold Service and Acoustic Insulated
O--Hot Oil Traced and Insulated
R--Refrigeration Conservation
U--Underground

14. INSULATION MATERIAL CLASS

An insulation material class code consisting of two letters is used to specify the insulation system required. A description of the code and an example class code is given below.

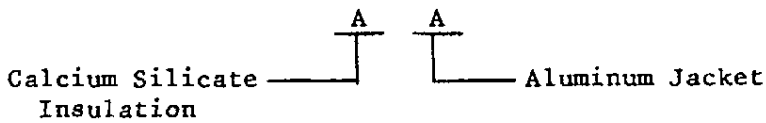
The first letter indicates the insulation material(s) as follows:

A--Calcium Silicate
C--Cellular Glass
G--Glass Fiber
I--Glass Fiber and Calcium Silicate
M--Mineral Fiber
U--Urethane Foam
X--Special

The second letter indicates the weatherproofing/coating system as follows:

A--Aluminum
G--Galvanized Steel
L--Weatherproofing Mastic
S--Stainless Steel
V--Vapor Barrier
X--Special

A typical insulation material class code is shown below.



15. INSULATION THICKNESS

The thickness for the appropriate pipe size, operating temperature, and plant location shall be obtained from Conoco Engineering Standard B, Insulation.

16. REMARKS

Special information or requirements are listed. For example, chemical or mechanical cleaning, seal welding, design for vibratory service, boiler external piping per ANSI/SME B31.1, need for postweld heat treatment or charpy testing, partial pressure of hydrogen, parts per million hydrogen sulfide, and identification of controlling short term variation.

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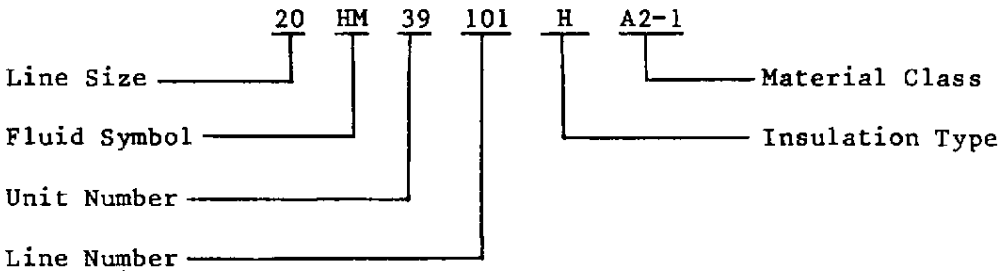
17. **COMPOSITE LINE DESIGNATION**

A combination of the letters and numbers decribed in this specification identifies each line. It includes line size, fluid symbol, unit or section number (as appropriate), line number, insulation type, and material class. For example:



18. **LINE SCHEDULE SHEETS**

Prepare the required number of completed sheets for distribution. See attached form 4-788S.

APPENDIX

Procedure for Selecting the Most Severe Coincident Pressure--Temperature Condition

1. In most instances, visual examination of normal operating conditions versus short term variation is sufficient to determine the most severe coincident pressure-temperature condition.

   Example:

   A cooling water supply line operating at 92°F and 60 psig is blocked in at the exchanger outlet. The cooling water supply pump shut-in pressure becomes the short term variation at 95°F and 100 psig. The more severe coincident condition is 95°F and 100 psig.

   Example:

   A hydrocarbon piping system takes suction from a tower through a pump and discharges through an exchanger. The pump discharge line, operating at 440°F and 120 psig, is blocked in at the exchanger. The pump shut-in pressure becomes a short term variation at 440°F and 155 psig. An anticipated upset condition in the tower will cause the pump discharge line to rise in temperature to 490°F and 120 psig, thus becoming another short term variation. The increase in pressure of 35 psig (29 percent) is more significant than the 50°F rise in temperature. The most severe coincident condition is 440°F and 155 psig.

2. There will be instances where visual examination is not sufficient to determine the most severe coincident pressure-temperature condition, such as conditions displaying wide variances of temperature with coincident pressures that approach the maximum allowable working pressures for a specific flange class rating and flange material group.

   For these situations, the use of flange rating tables as presented in Standards Reference Material AR-101 or ANSI B16.5-1981, in either liner or graphic form, shall be necessary. For intermediate temperatures, linear interpolation shall be used to determine the coincident maximum allowable working pressure.

   The concept of severity ratio shall then be applied. The severity ratio is the ratio of prevailing pressure to the maximum allowable working pressure at the prevailing temperature. The condition with the greatest severity ratio shall become the most severe coincident pressure-temperature condition.

Example:

A carbon steel line is expected to experience the following coincident conditions:

	Operating	Variation #1	Variation #2
PSIG	680	620	500
°F	150	250	750

A visual examination of the flange class rating tables for material group 1.1 (carbon steel) indicates that the maximum allowable working pressure for ANSI Class 300 will not be exceeded, using linear interpolation for intermediate temperatures.

The next step is to divide the pressures listed above by the maximum allowable working pressure for ANSI Class 300 for each temperature listed above.

Operating	Variation #1	Variation #2
$\frac{680}{707.5} = 0.96$	$\frac{620}{665} = 0.93$	$\frac{500}{505} = 0.99$

The highest severity ratio of 0.99 indicates that 750°F and 500 psig is the most severe coincident condition.

3. The most severe coincident condition, as determined by the methods described above, is entered as the basis for code design.

To _____

From _____ Calculation Sheet

VISTA

19.4 MM LB/YR PLANT

	¢/LB FEED
H_2 –	10.5
CAUSTIC	0.5
CATALYST	0.5
Utilities	4.0
Residue	0.9
~~CAPITAL~~ MAINT.	1.1
LICENSE	9.0
	26.5

LICENSE FEE

$200/MT of feed

.090

2205) 200.00

19845

1550

AREA – 50' x 75'

$400,000

Operate cats – $3.71 MM

L.E. Sales Loans

Disposal Savings –(0.40)MM)

HCl Value (0.53MM)

NC Value (1.04 MM)

Use 20¢/LB FOR NC

$1.74 MM ~~Loss~~

$400,000 / 12

$14MM for next 10 years

$125/TON – $225/TON = $100/TON = 5¢/LB

225
0.4
90.0

125 – 90 = $35/TON

Made By _____

Date _____

Page _____ of _____

CWH 000008219

Job No. _____

Title _____

V3-20G-5

To UOP PRESENTATION --

From 1/11/89

Calculation Sheet

VISTA

PILOT PLANT STUDY TO DATE

Send HC Stream to Gillis thru pipeline that runs north of LCCP?

What about working w/ PPG — have them build a plant — since they get H.P.'s / L.E.'s from ll ovv — & provided an outlet for the HC stream?

Also, send them H_2?

Utilities

$ 5.25 MM — 1A
1B
$ 6.1 MM 2A
2B

Basis

1.5 op/shift
0.25 supervision/shift
H_2 — $10/MSCF
11.8¢/LB

$1/MM 11.8¢/LB of feed.

CAUSTIC	0.5¢/LB FEED		
CATALYST	0.5¢/LB FEED		
UTILITIES	4.5¢/LB FEED	(7¢/KWH)	($2/MMBTU)
Residue disposal	0.9¢/LB FEED	$200/MT.	
MAINT	3½% of unit price		

~~HF~~ HCl — 6 to 7 ¢/LB

CWH 000008220

Made By _____ Job No. _____

Date _____ Title _____

Page _____ of _____

V3-20G-S