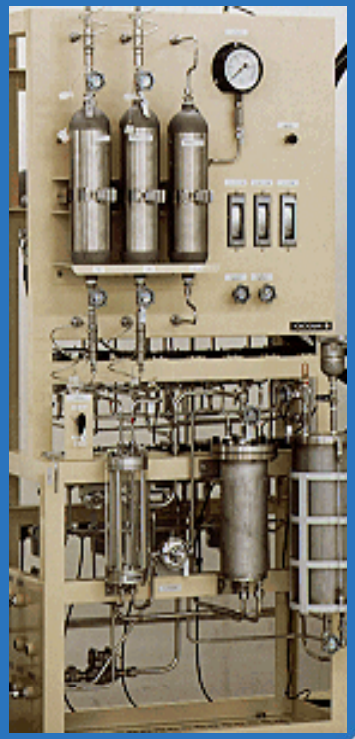
Sampling Systems



Sample Systems

Sistemi di condizionamento campione:

Gli analizzatori di processo ed i gascromatografi richiedono l'utilizzo di un sistema di trattamento / condizionamento del campione.

Questo sistema può essere molto semplice, solo una riduzione di pressione, oppure essere molto più complesso, quando è necessario filtrare campioni molto sporchi, rimuovere sostanze aggressive o condense che possono danneggiare gli analizzatori.

Un design inadatto del sistema di campionamento è una delle cause primarie dei guasti degli analizzatori e di costi di manutenzione elevati.

Sample Systems

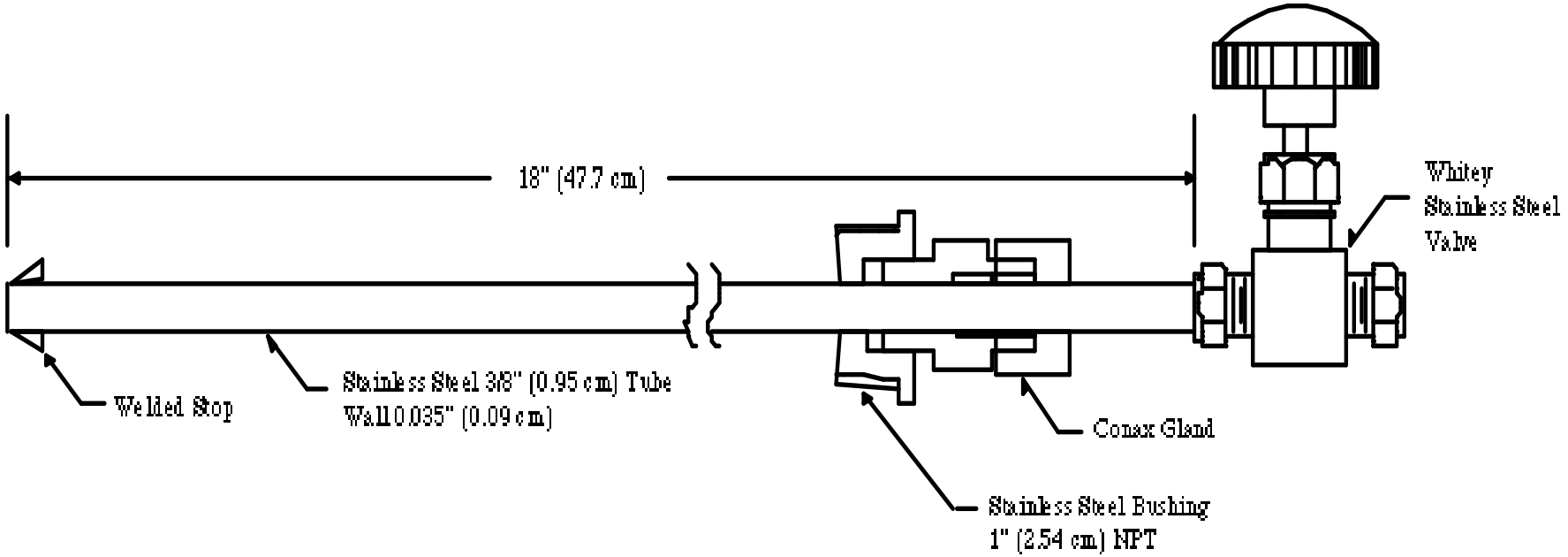
- Sistemi di condizioanmento campione
  - Sonde di prelievo
  - Linea trasporto campione
  - Filtraggio e mantenimento della fase
    - Filtrazione
    - Coalescenza
    - Tracciatura
- Fast Loop
- Stream switching automatico
  - Calibrazioni
  - Sistemi multi stream

Sample Systems

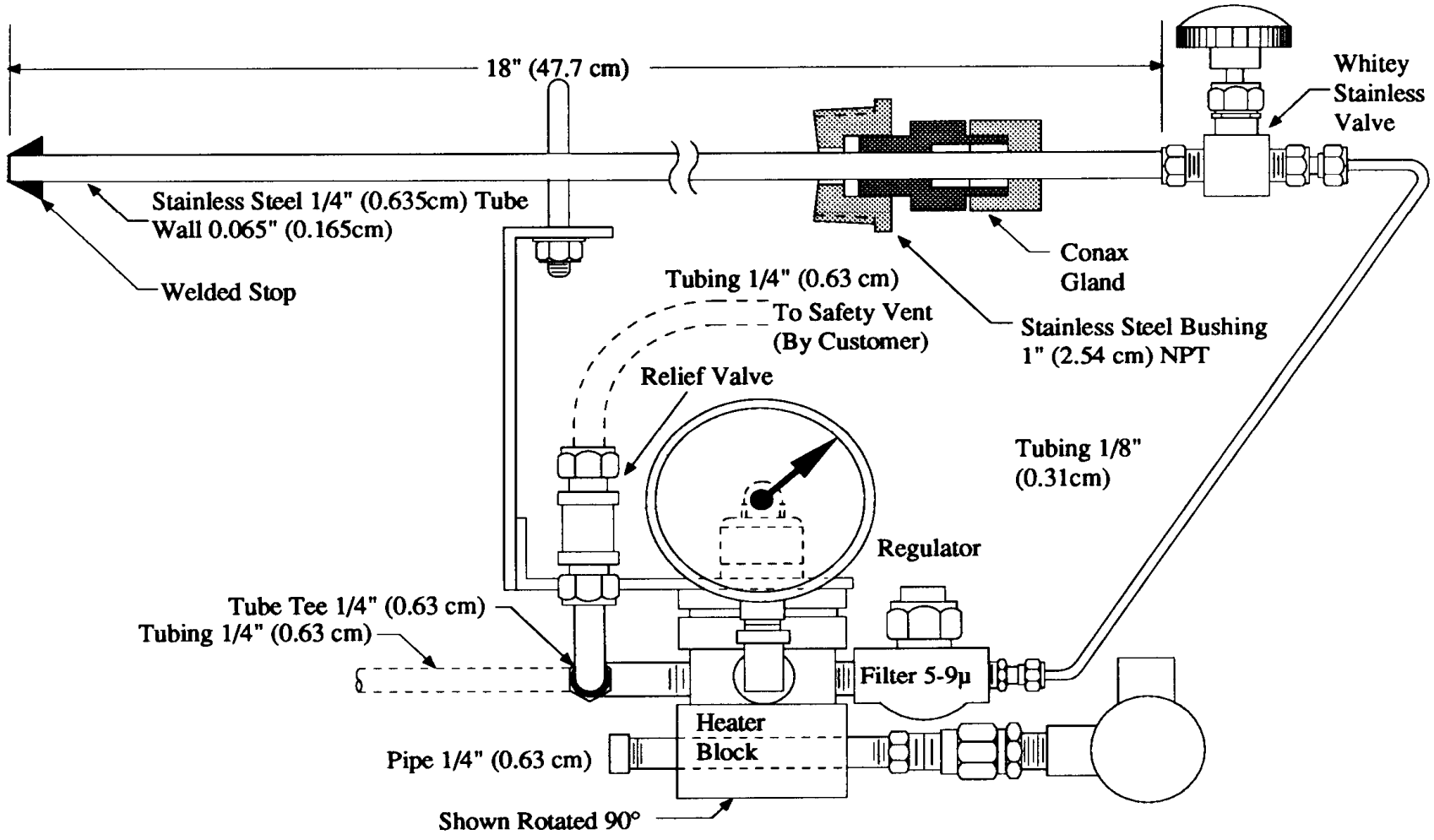
Per quanto un analizzatore on-line sia preciso e perfezionato, le sue misure saranno affidabili solamente se il campione che analizza è rappresentativo di quello prelevato dalla linea di processo.

- Il primo elemento del sistema è la sonda di prelievo:
  Ne esistono tipi differenti:
  - Sonde per gas
  - Sonde per liquidi
  - Sonde con vaporizzatore / regolatore di pressione
  - Esecuzioni speciali per processi con campioni particolarmente corrosivi o condensabili

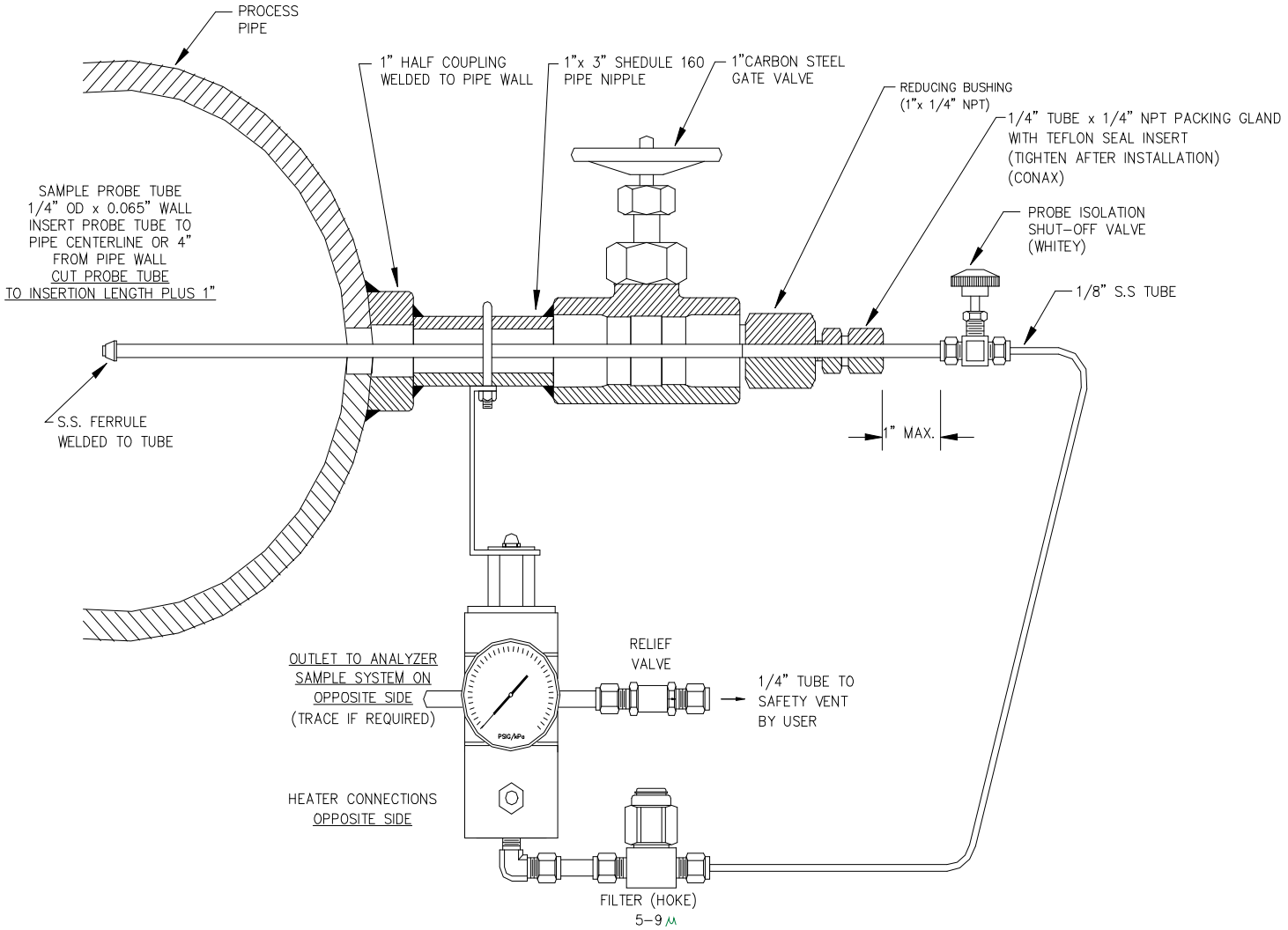
Sonda per liquidi



Sonda con vaporizzatore



Installazione tipica



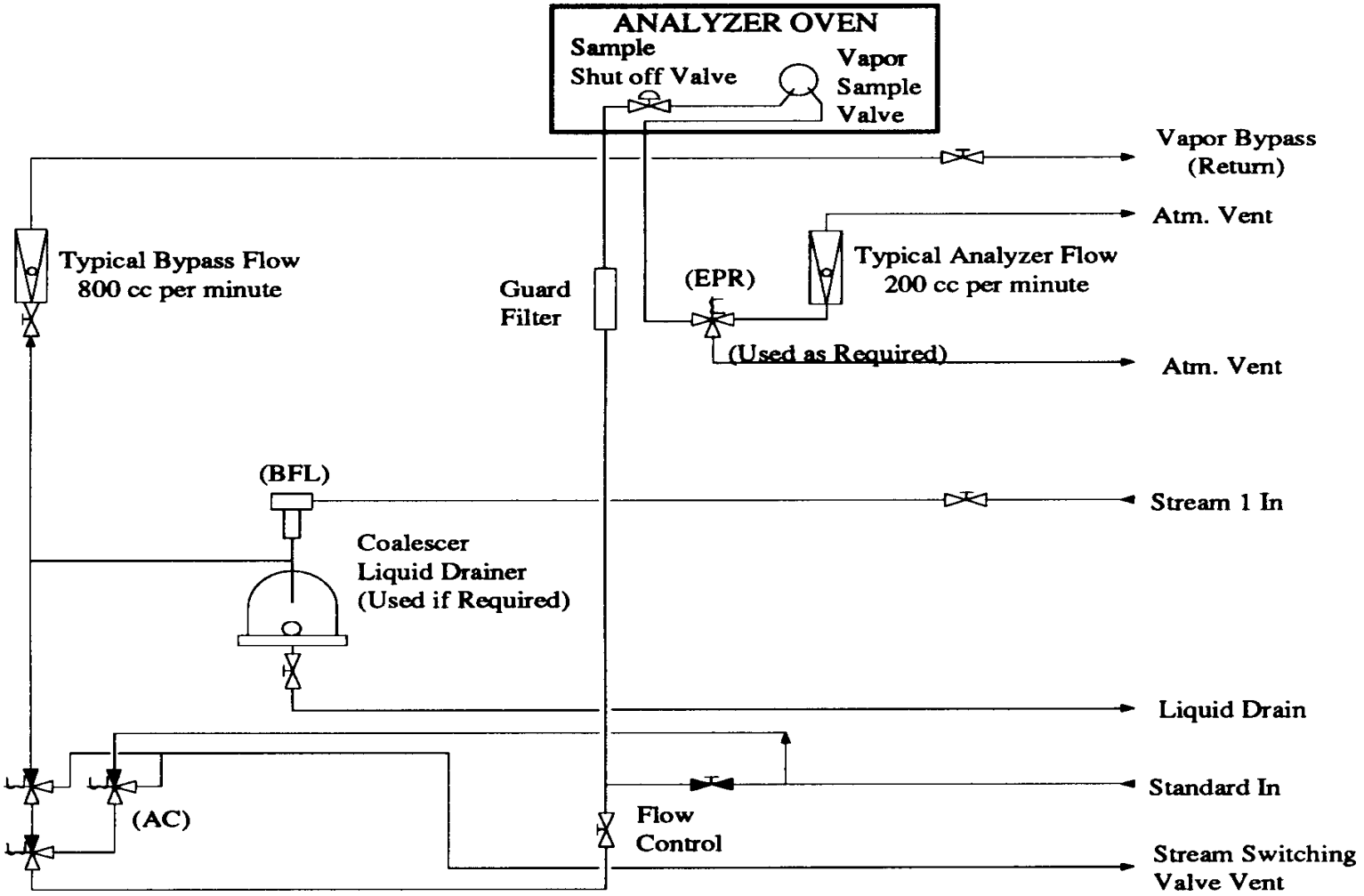
Condizionamento remoto – Linee di trasporto

- Filtrazione
- Diluizione
- Rimozione condense acide

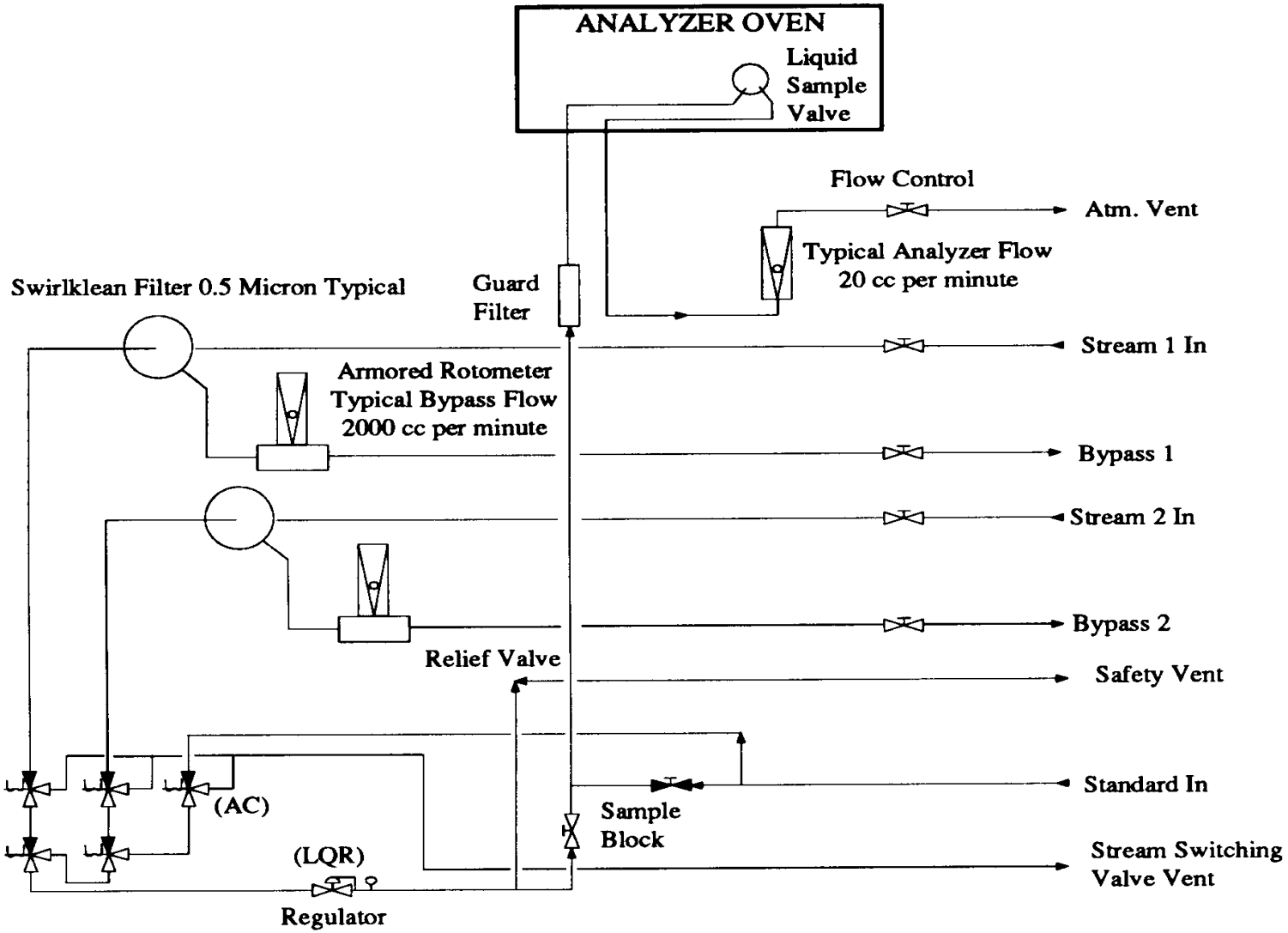
Linee di trasporto

- 1/4” Tubing utilizzato per campioni gassosi
- 3/8” Tubing utilizzato per campioni liquidi
- In genere in AISI 316, ma possibile l’uso di PTFE
- Spesso le linee sono isolate o riscaldate
  - Autoregolanti
  - Con regolatore di temperatura

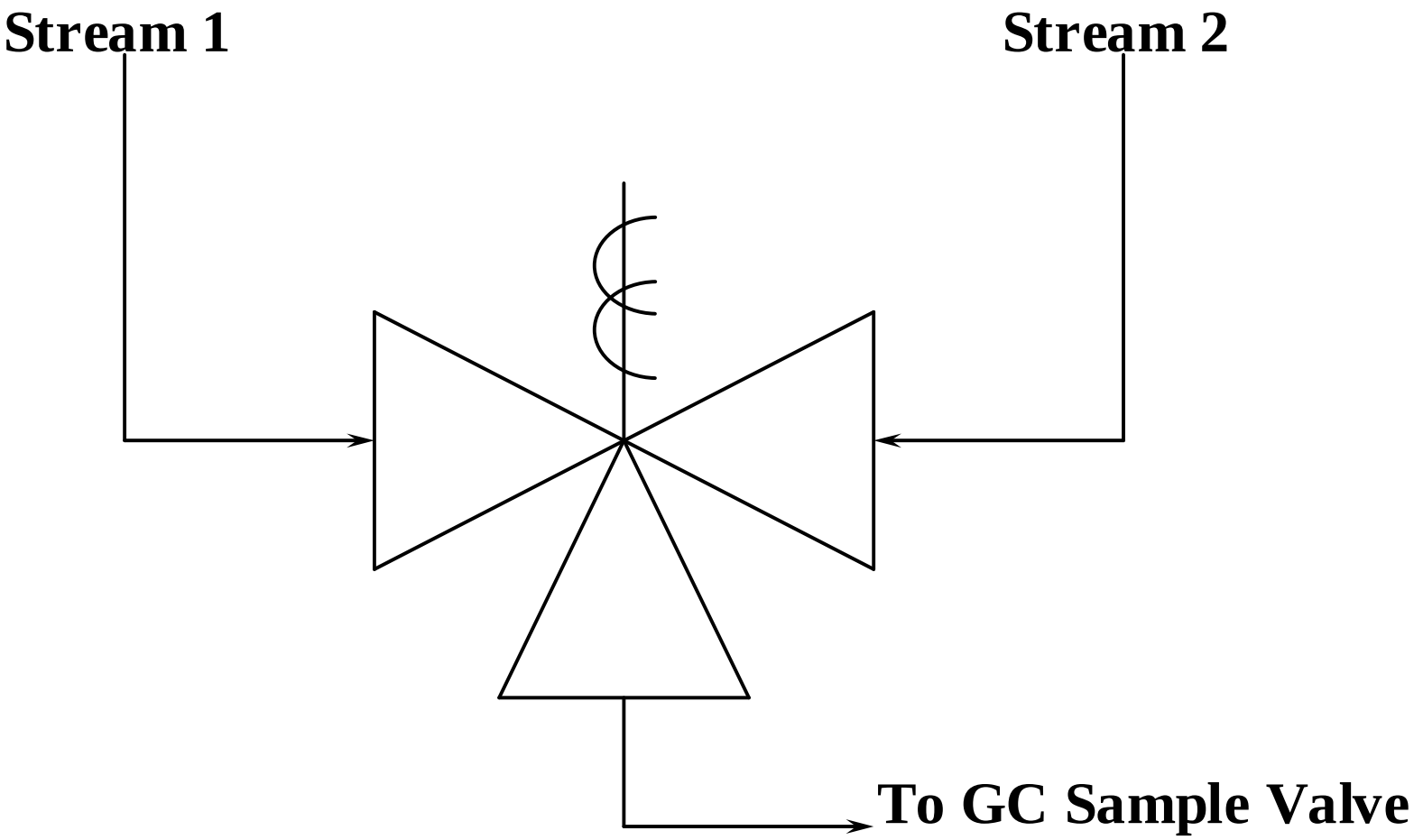
1 Stream gas


ANALYZER OVEN
Sample
Shut off Valve
Vapor
Sample
Valve
Vapor Bypass
(Return)
Atm. Vent
Typical Bypass Flow
800 cc per minute
Guard
Filter
(EPR)
Typical Analyzer Flow
200 cc per minute
(Used as Required)
Atm. Vent
(BFL)
Stream 1 In
Coalescer
Liquid Drainer
(Used if Required)
Liquid Drain
Standard In
(AC)
Flow
Control
Stream Switching
Valve Vent

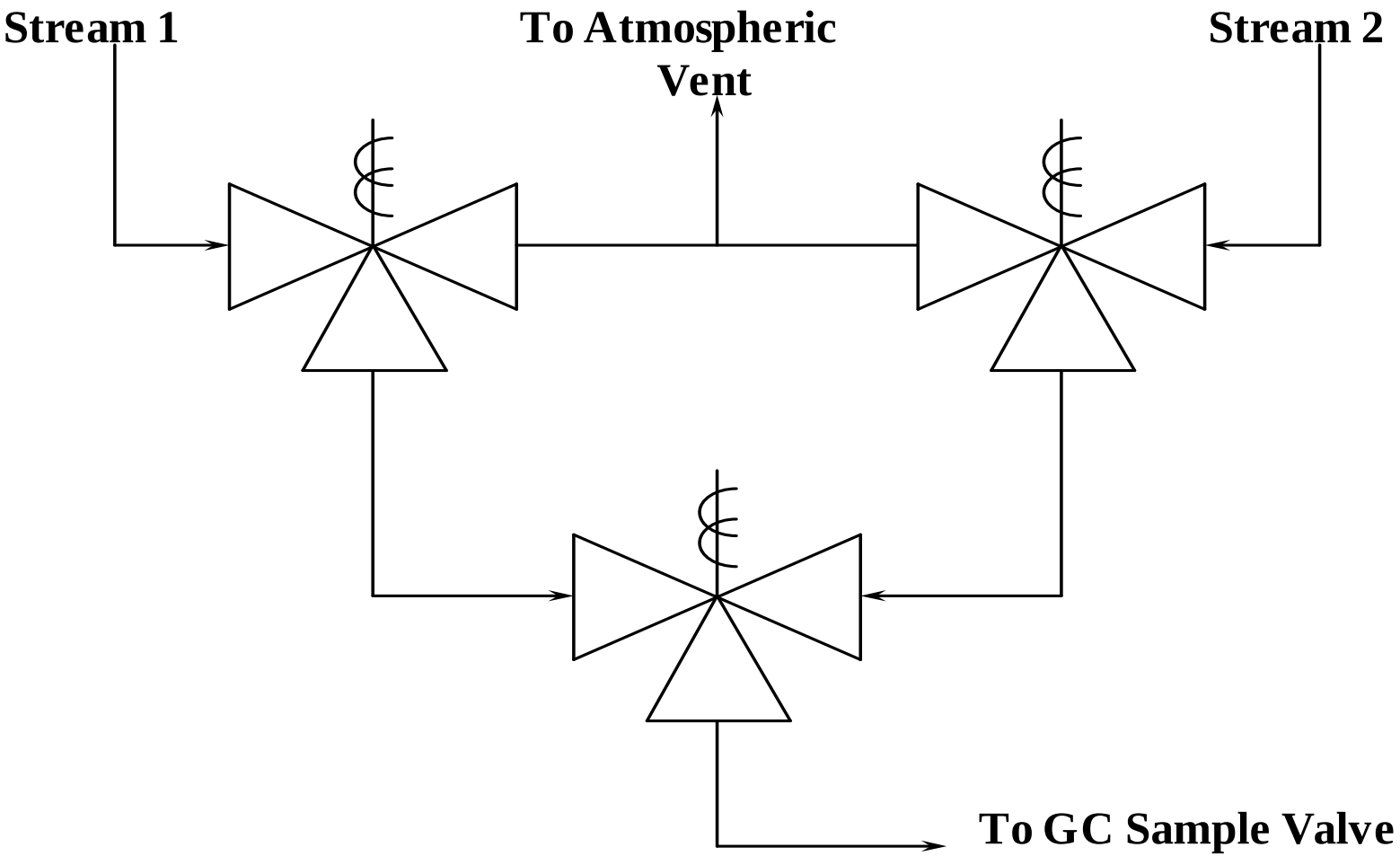
2 Stream liquidi



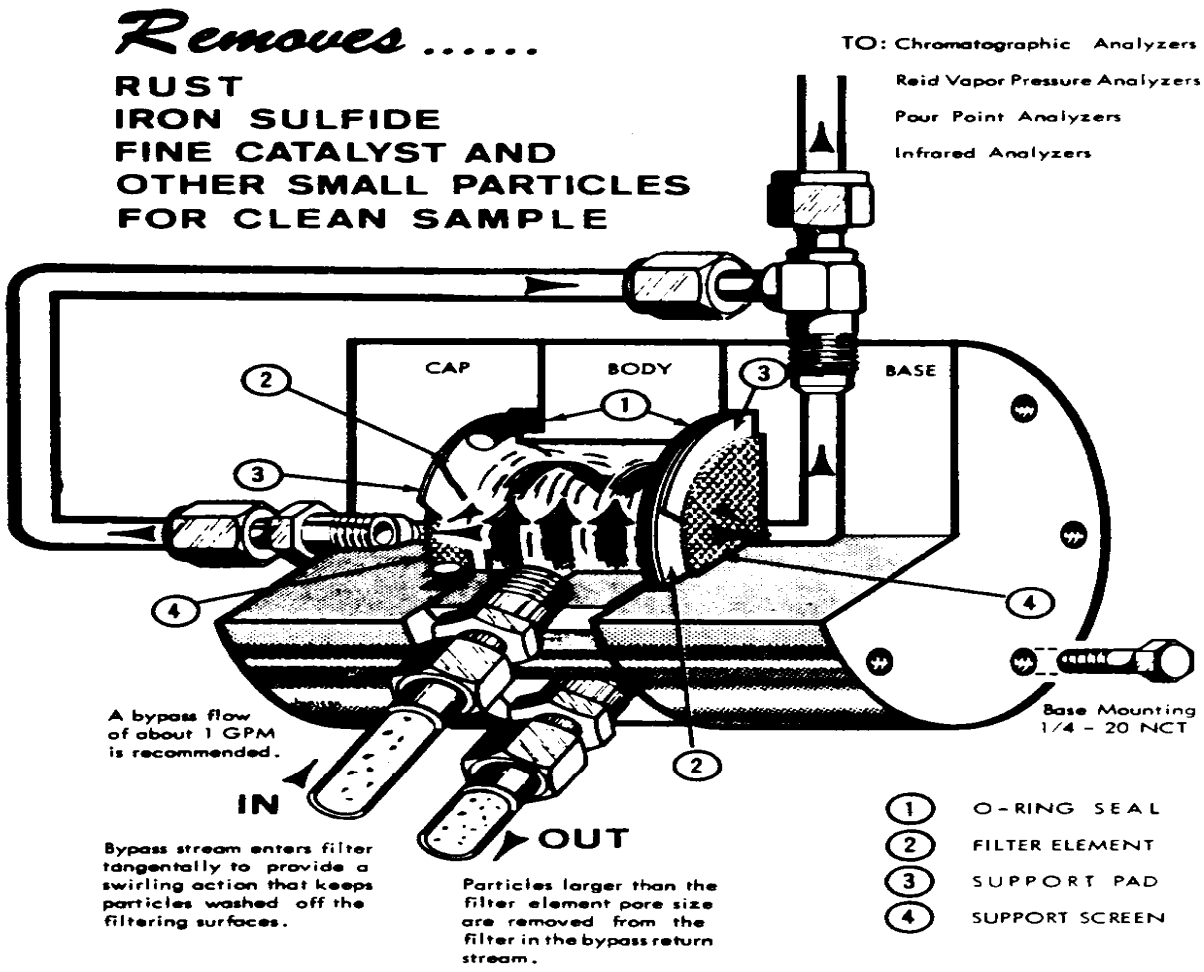
Commutazione stream



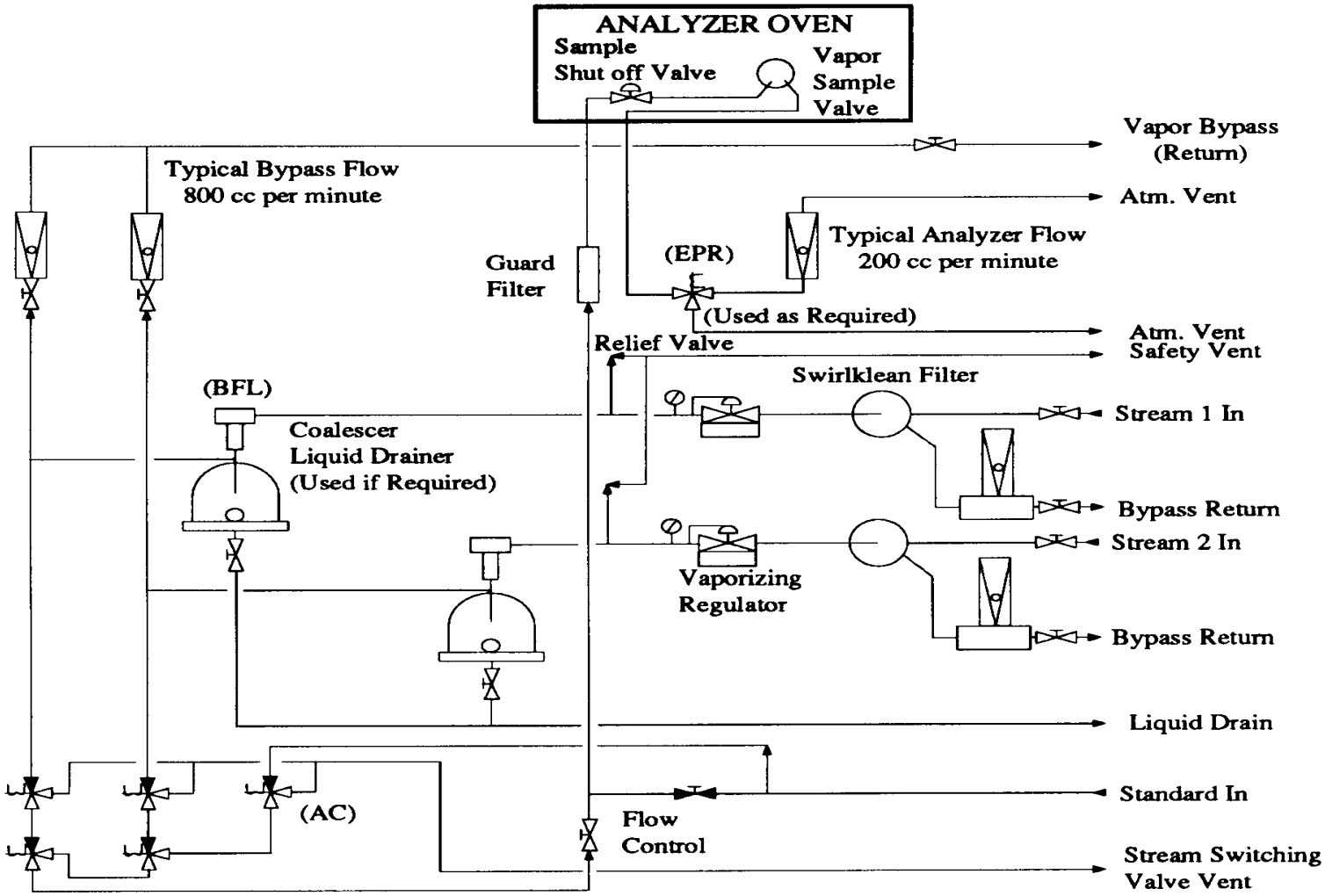
Double Block And Bleed



Filtro Collins SwirlKlean Filter (Self-Cleaning)



2 Stream liquidi con vaporizzazione



Funzioni di un sistema di campionamento

- Regolazione di pressione, temperatura e portata
- Valvole di intercetto su tutte le linee campione
- Fast Loop
- Misura portata (rotametri) sul fast loop e sulla linea analizzatore
- Rotametri armati sulle linee campioni liquidi
- Valvole di sicurezza (PSV)

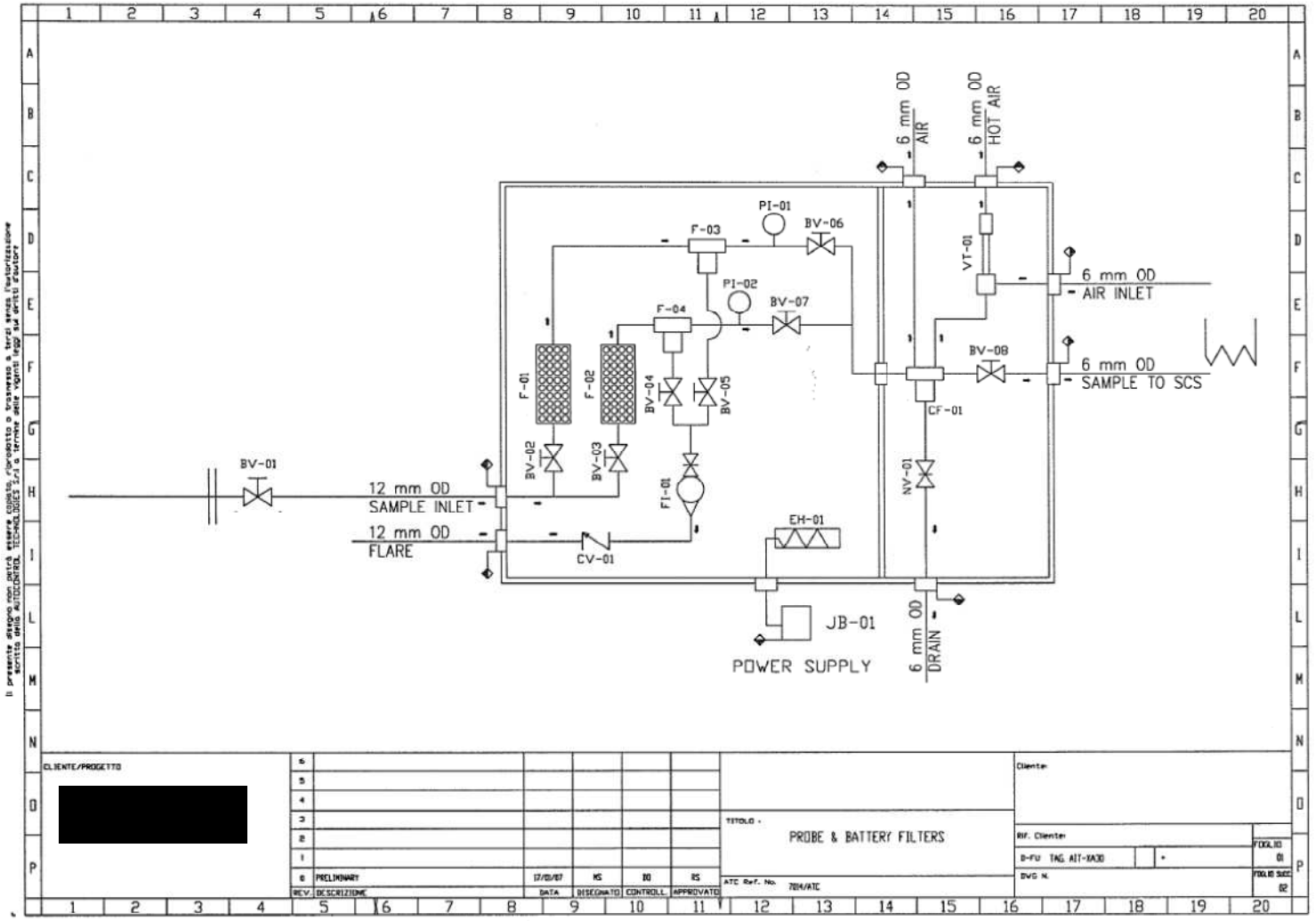
Opzionali:

- Calibrazione automatica
- Pompe o aspiratori
- Sistemi di recupero campione
- Prese campione per laboratorio
- Cabinet (box riscaldati o isolati)

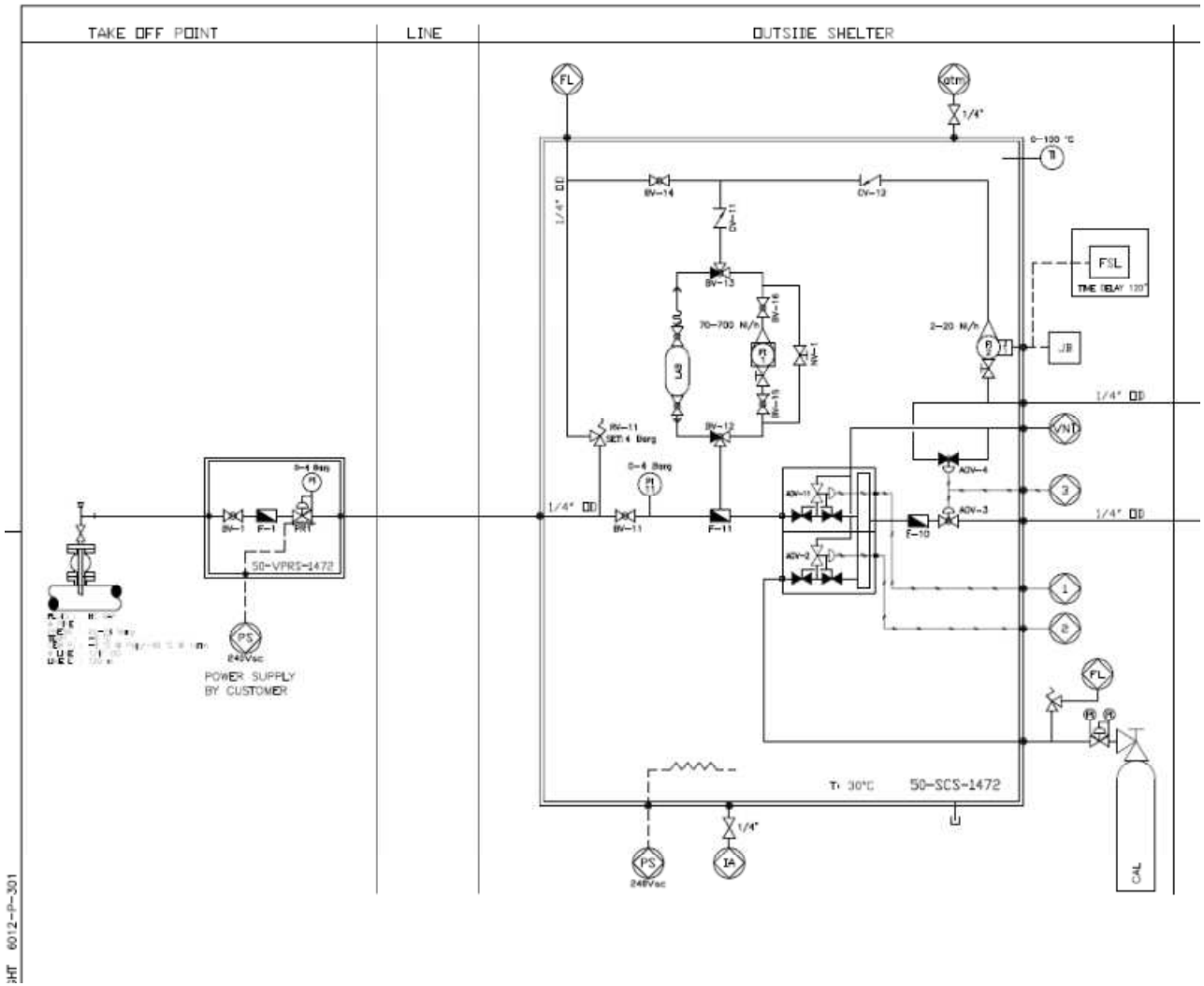
Dati necessari per una corretta ingegnerizzazione

- Temperatura e pressione al punto di prelievo
- Fase (bifase → no analisi !!)
- Composizione campione (normale + upset)
- Particolato (tipo e dimensione)
- Dew point acqua
- Dew point acido
- Tendenza alla polimerizzazione

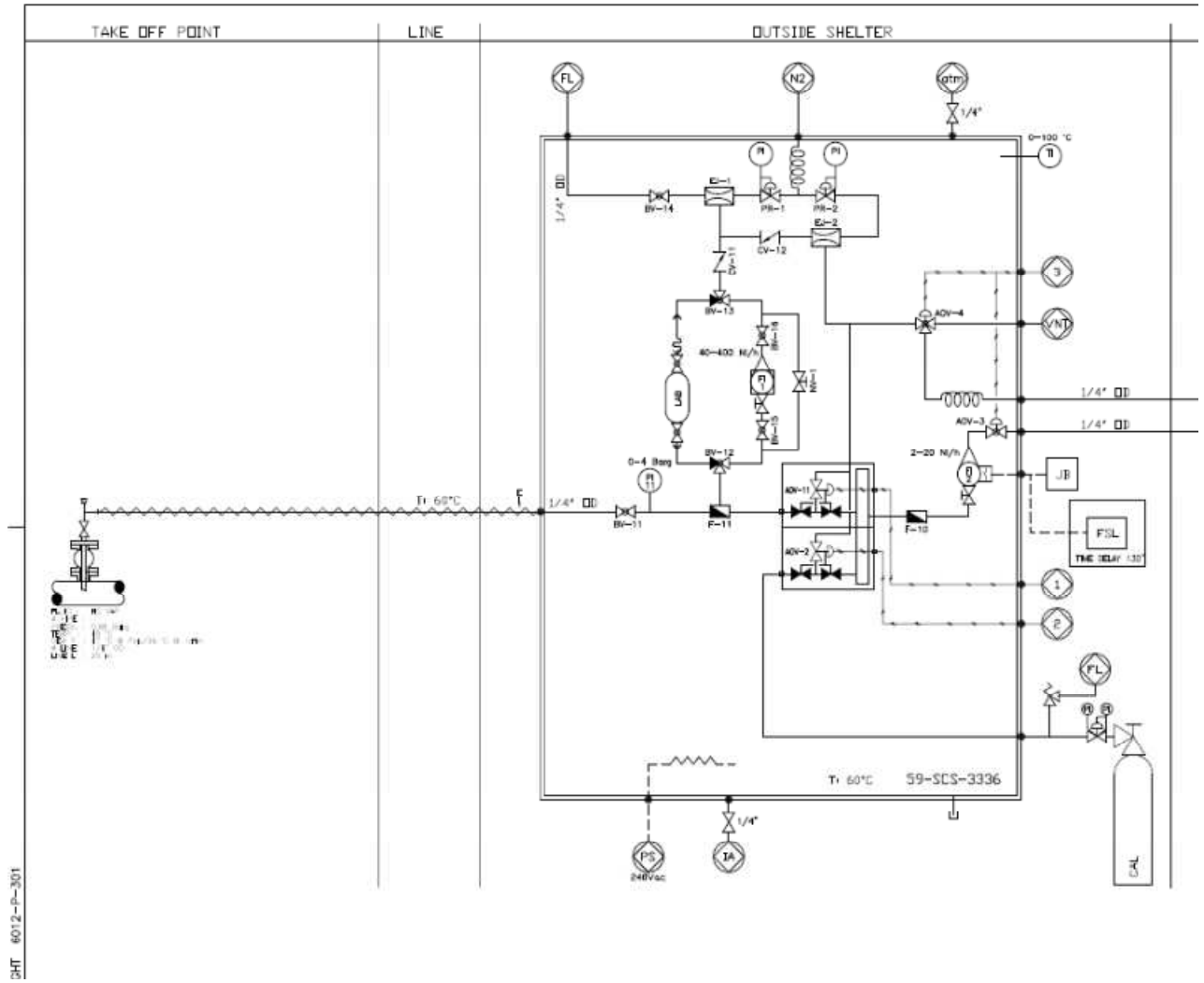
Filtrazione alla presa



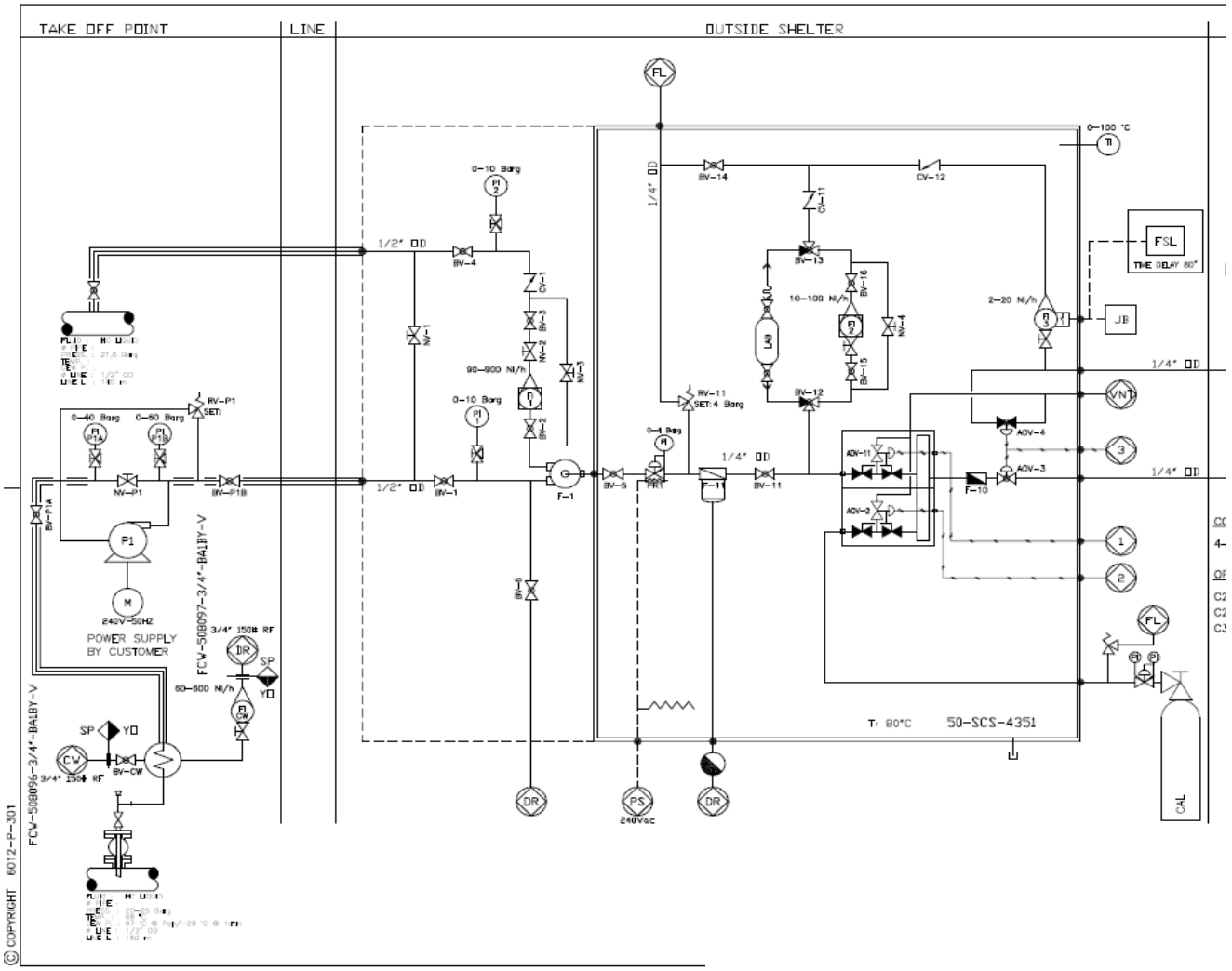
Campione LNG: HC con riduzione pressione



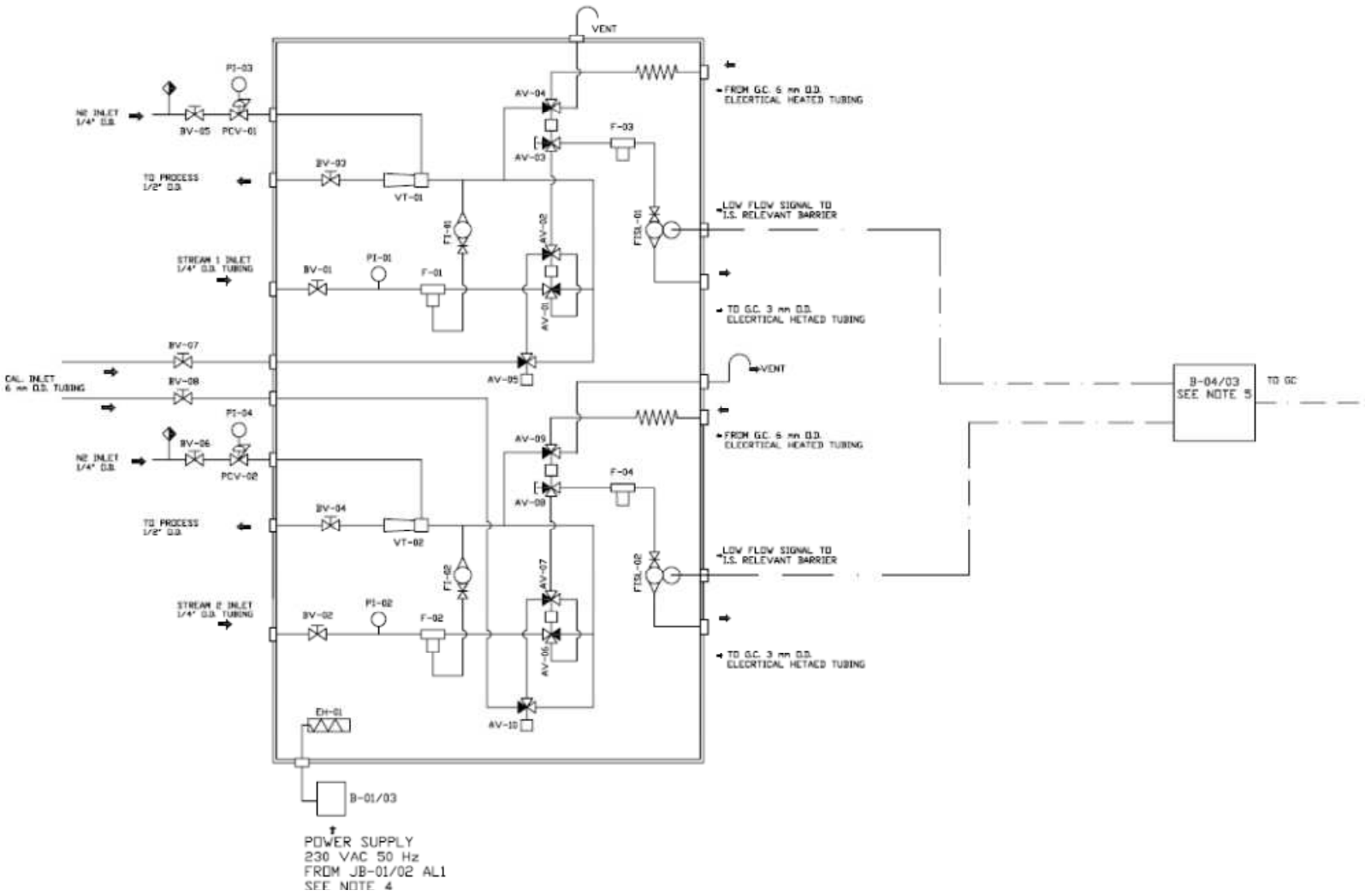
Campione LNG: HC bassa pressione con aspiratore



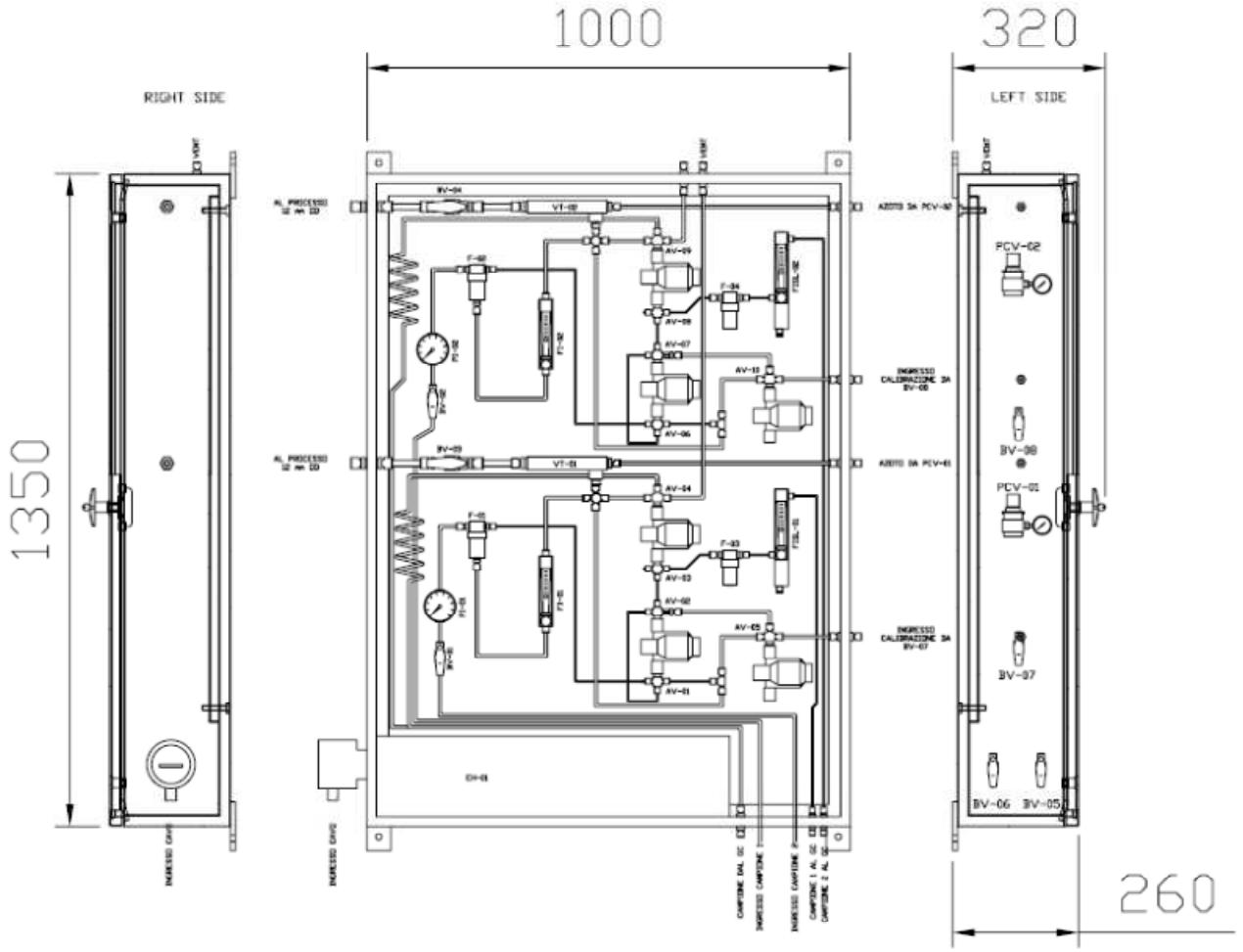
Campione LNG: HC liquidi con pompa



2 stream in parallelo



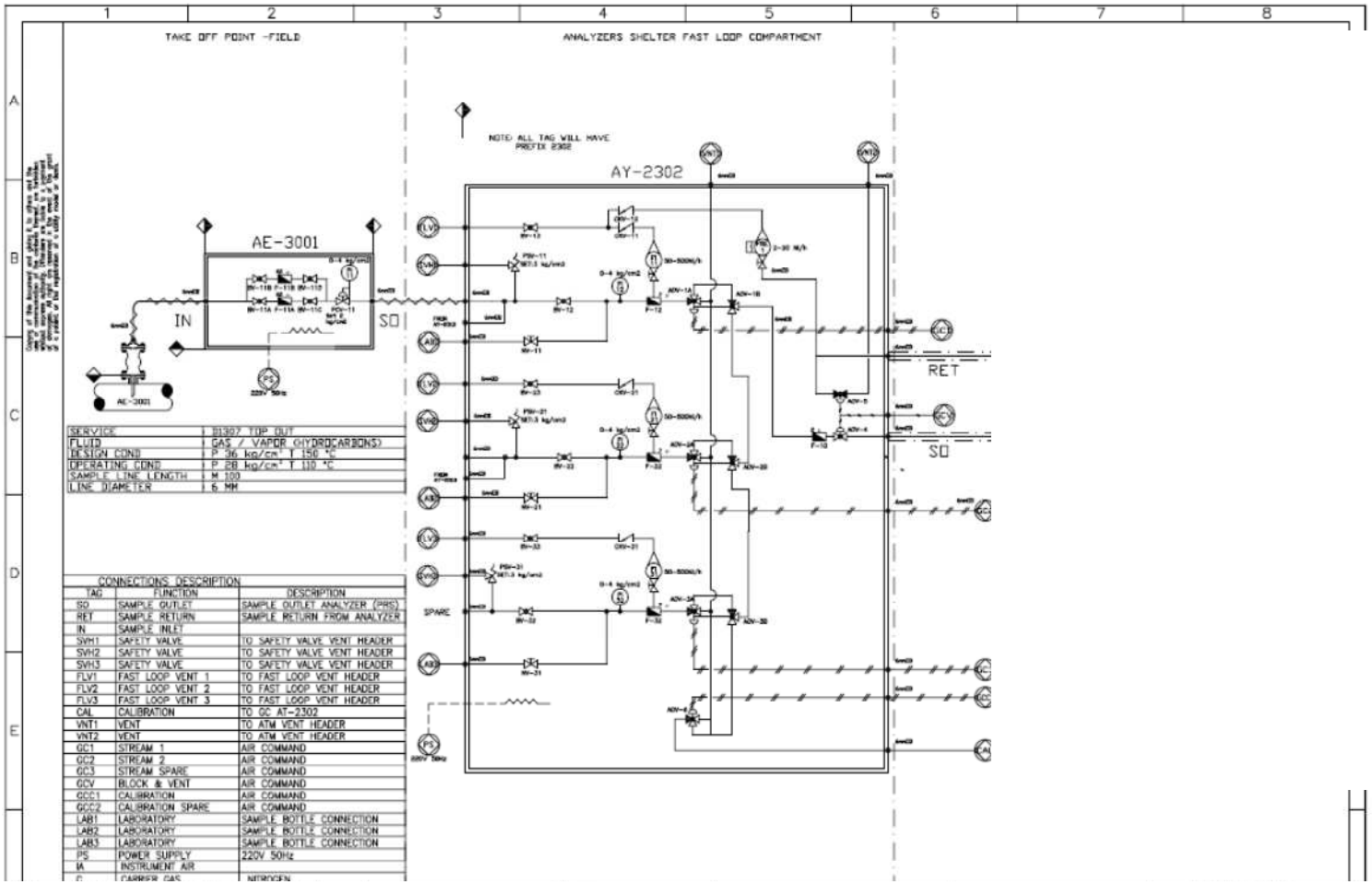
2 stream in parallelo: Layout



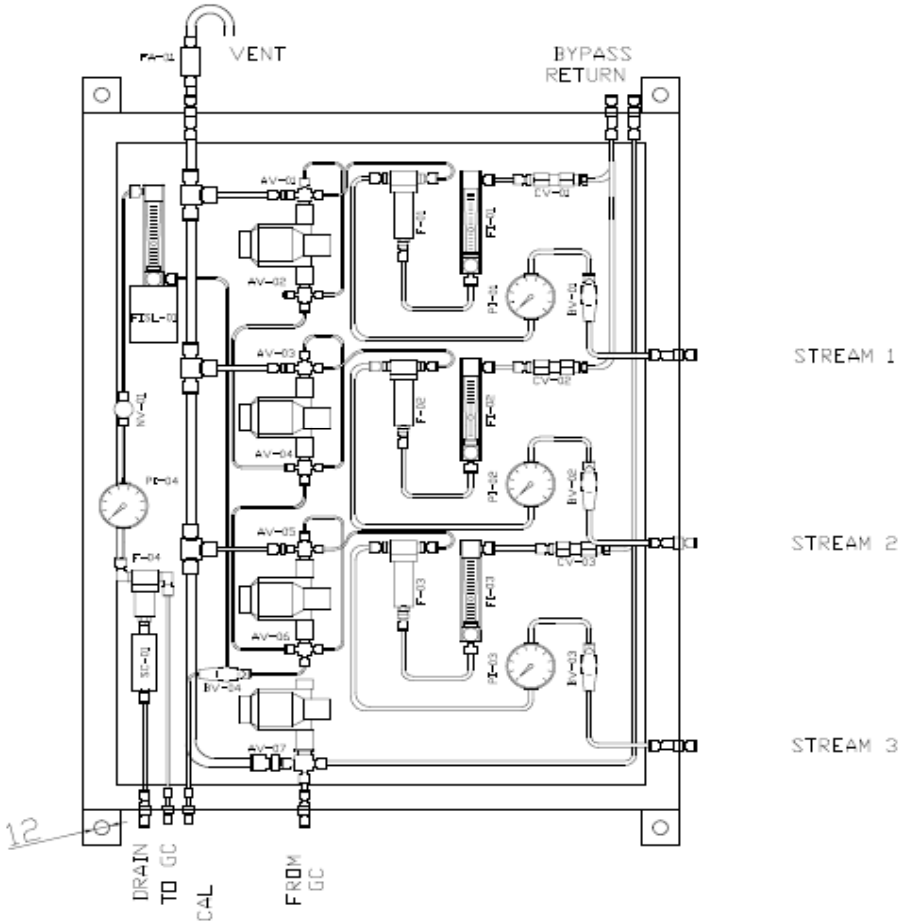
2 stream in parallelo : Part List

TAG	DESCRIPTION	MATERIAL	MANUFACTURER	MODEL	RANGE	SET
SHS PART LIST						
BV-01	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
BV-02	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
BV-03	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
BV-04	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
BV-05	2 WAY BALL VALVE	S.S./PTFE	ALFA	20K	T MAX 150 °C P MAX 68 BAR	N.A.
BV-06	2 WAY BALL VALVE	S.S./PTFE	ALFA	20K	T MAX 150 °C P MAX 68 BAR	N.A.
BV-07	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM	T MAX 150 °C P MAX 68 BAR	N.A.
BV-08	2 WAY BALL VALVE	S.S./PTFE	SWAGELOCK	SS-42GS6MM	T MAX 150 °C P MAX 68 BAR	N.A.
AV-01	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-02	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-03	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-04	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-05	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-06	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-07	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-08	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-09	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
AV-10	3 WAY ACTUATED BALL VALVE	S.S./PTFE	SWAGELOCK	SS-41XGS3MM-SG	T MAX 150 °C P MAX 68 BAR	N.A.
F-01	BY PASS FILTER	S.S.	CLASSIC FILTER	SS127.221_	T MAX 200°C P MAX 100 BAR	MICRON
F-02	BY PASS FILTER	S.S.	CLASSIC FILTER	SS127.221_	T MAX 200°C P MAX 100 BAR	MICRON
F-03	IN LINE FILTER	S.S.	SWAGELOCK	SS117.221_	T MAX 200°C P MAX 100 BAR	MICRON
F-04	IN LINE FILTER	S.S.	SWAGELOCK	SS117.221_	T MAX 200°C P MAX 100 BAR	MICRON
PI-01	PRESSURE GAUGE	S.S.	SWAGELOCK	PGI-63B-BC3-CASX	P MAX 3 BAR	N.A.
PI-02	PRESSURE GAUGE	S.S.	SWAGELOCK	PGI-63B-BC3-CASX	P MAX 3 BAR	N.A.
PI-03	PRESSURE GAUGE	S.S.	ADAMI	111040006P	P MAX 6 BAR	N.A.
PI-04	PRESSURE GAUGE	S.S.	ADAMI	111040006P	P MAX 6 BAR	N.A.
FI-01	FLOWMETER	S.S.	KROHNE	DK800/R	10 - 100 L/H T MAX 100°C	"
FI-02	FLOWMETER	S.S.	KROHNE	DK800/R	10 - 100 L/H T MAX 100°C	"
FISL-01	SWITCHED FLOWMETER	SS/GLASS	KROHNE	DK800/R/K"	2 - 20 L/H T MAX 100° C	"
FISL-02	SWITCHED FLOWMETER	SS/GLASS	KROHNE	DK800/R/K"	2 - 20 L/H T MAX 100° C	"
VT-01	EJECTOR	S.S.	F.E.D.	DN 3/8" - 1/2"	SUCTION MAX 3 m3/H	N.A.
VT-02	EJECTOR	S.S.	F.E.D.	DN 3/8" - 1/2"	SUCTION MAX 3 m3/H	N.A.
PCV-01	PRESSURE REGULATOR	AL	SMC	AR20F02	P MAX INLET 8 BAR	"
PCV-01	PRESSURE REGULATOR	AL	SMC	AR20F02	P MAX INLET 8 BAR	"
EH-01	ELECTRICAL HEATER	IRON/S.S.	F.A.T.I.	"	"	65°C

Applicazione su PE, multistream



Three Streams sampling system: layout



Applicazione su PE, multistream : part list

TAG	DESCRIPTION	MANUFACTURER	MODEL
BV-11A / BV-11B / BV-11C / BV-11D	Ball valve	Swagelok	SS-42GS6MM
BV-12 / BV-13 / BV-22 / BV-23 / BV-32 / BV- 33	Ball valve	Swagelok	SS-42GS6MM
NV-11 / NV-21 / NV-31	Needle valve	Swagelok	SS-1RS6MM
AOV-1A&B / AOV-2A&B / AOV-3A&B	Pneumatic actuated valve	Swagelok	SS-42XGS6MM-51-C-DM
AOV-3	Pneumatic actuated valve	Swagelok	SS-32F2-O-LT
AOV-4	Pneumatic actuated valve	Swagelok	SS-32S6MM-C-LT
AOV-6	Pneumatic actuated valve	Swagelok	SS-42XGS6MM-51-C
CKV-12 / CKV-13 / CKV-21 / CKV-31	Check valve	Swagelok	SS-6C-MM-1/3
PSV-11 / PSV-21 / PSV-31	Relief valve	Swagelok	SS-RL3S6MM + 177-13K-RL3
PI-11 / PI-12 / PI-22 / PI-32	Pressure gauge	Swagelok	PGI-63B-LG.4-CAQX-E
FI-11 / FI-21 / FI-31	Flowmeter	Krohne	DK32
FISL-1	Flowmeter with low flow alarm	Krohne	DK46
A	Alarm barrier	Pepperl+Fuchs Elcon	KFA6-DU-Ex1.D
F-11A / F-11B	In line filter 60 micron	Swagelok	SS-6TF-MM-60
F-12 / F-22 / F-32	By-pass filter 50 micron	Swagelok	SS-6TF-MM-50-F2
F-10 / F-11	In line filter 7 micron	Swagelok	SS-6TF-MM-7
PCV-11	Pressure regulator	Go inc.	PR1 1B11Q3E111
VPR-11 / VPR-21	Pressure regulator electrical heated	Go inc.	HPR-2 1Y43Q3E4111
PRS HEATER	Electrical heater 200 W	F.A.T.I. S.r.l.	Convector Heater
SCS HEATER	Electrical heater 400 W	F.A.T.I. S.r.l.	Convector Heater

Calcolo Fast Loop (1)

LEGEND		DESCRIPTION
Phase at TP		Sample phase at take off point
MW		Molecular Weight
STD density		Density at standard condition P ATM and T=0°C
Average line conditions		
	density	Average Density between take off point(after PRS) and SCS inlet
	P (Kg/cm2)	Pressure at take off point; if gas sample, indicated pressure is at PRS outlet
	T (°C)	Average Temperature between take off point and SCS inlet
	Viscosity	Average Viscosity between take off point and SCS inlet
FL line data		
	FL Sample Velocity	Sample velocity in FL line
	FL Flow rate (kg/h)	Sample Flow in FL line
	Equivalent Line Lng.(mt)	Process Line lenght + 20% spare
	Press. drop FL(Kg/cm2)	Pressure drop between take off point (if gas sample, PRS outlet) and SCS inlet
Pressure at SCS Inlet		Pressure at SCS Inlet
Internal F.L. Press drop		Pressure drop due to Internal FL components
Return line		
	Line Lng.(mt)	Return line lenght, N/A if discharge is Drain or Flare
	Press. drop FL(Kg/cm2)	Pressure drop between SCS outlet and return point
Return Pressure	P (Kg/cm2)	Pressure at return point
Delta P available		Delta Pressure between take off and return point
Delta P required		Delta Pressure between take off and return point required to avoid pumping station
FI-1 Lt/hr ACT		Sample flow in FL at actual conditions
FI1 Nl/hr STD		Sample flow in FL at standard condition P ATM and T=0°C
Line Data		
	FL Line Type	Line type
	heating tmp °C	Line temperature rate
SCS Data/Sample Cond at SCS inlet		
	Temp(°C)	Temperature at SCS inlet
	Dens (kg/m3)	Density at SCS Inlet
	Viscos (cP)	Viscosity at SCS Inlet
Transport time (sec)		Transport time from take off point (if gas sample, PRS outlet) to analyzer
Feed line data		
	Frict Factor	Friction Factor
	Reynolds	Reynolds number

Calcolo Fast Loop (2)

TCM NKNK Fast Loop calculation

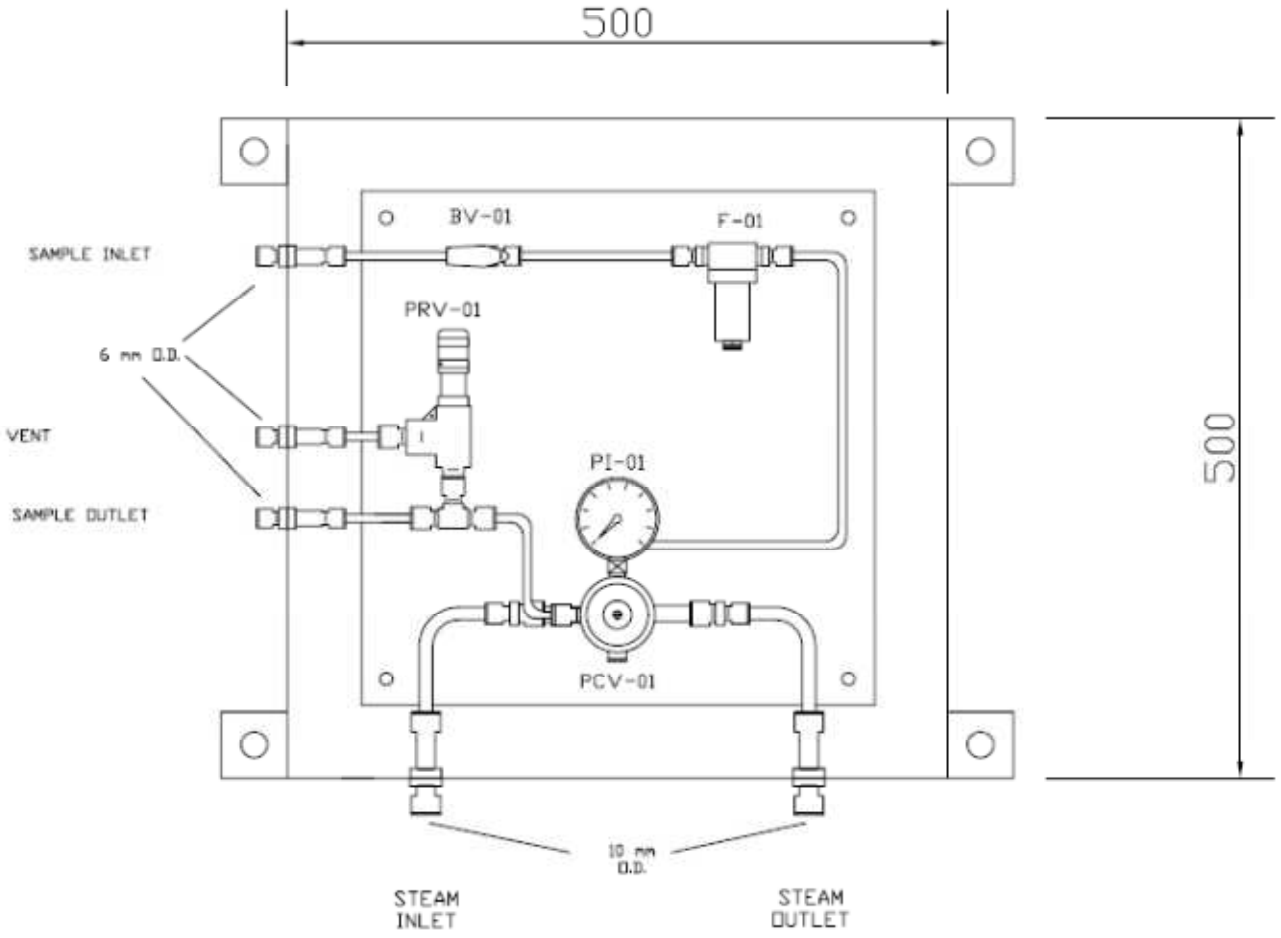
TAG Sample lines	Phase at TP	MW	STD density	Average Line conditions				FL Line data				Pressure at SCS Inlet	Internal FL Press drop	Return Line		Rel. Press	Delta P available	Delta P required	FI-1 Line ACT	FI1 Nom STD	FL Line Data		SCS Data				Calculated data		Dew point at FL-out	BBL at FLout
				dens.	P (Kg/cm2)	T(°C)	Viscosity	FL sample Velocity	FL Flow rate (kg/h)	Equivalent Line Lng.(mt)	Press. drop FL (Kg/cm2)			Line Lng.(mt)	Press. drop FL (Kg/cm2)	P (Kg/cm2)						FL Line Type	FL pump	Sample Cond at SCS Inlet			Transport time (sec)	Feed line data			
																							Temp	Dens	Viscos		Friction factor	Reynolds Number		
AE-2313	VAP-C2-C6	42,72	1,907	4,8	2,09	60	0,0095	2,80	0,61	110	0,1925	1,8075	0,2000	Flare	0	0,3	1,5000	0,3925	152	319	heated	Not Req	60	4,49	0,01	39	0,04	5658,95	12	
AE-2513	VAP C2-C6	41,72	1,862	4,6	2,09	60	0,0096	2,80	0,58	110	0,1874	1,8126	0,2000	Flare	0	0,3	1,5000	0,3874	153	313	heated	Not Req	60	4,3	0,01	39	0,04	5386,67	15,5	
AE-3031	VAP-C2-C6	34,535	1,54	3,8	2,09	60	0,0094	3,55	0,61	110	0,2439	1,7561	0,2000	Flare	0	0,3	1,5000	0,4439	212	396	heated	Not Req	60	3,5	0,01	31	0,04	5740,43	17	
AE-3032	VAP-C2-C6	34,535	1,54	3,7	2,09	60	0,0094	3,55	0,59	110	0,2394	1,7606	0,2000	Flare	0	0,3	1,5000	0,4394	208	386	heated	Not Req	60	3	0,01	31	0,04	5589,36	17	
AE7201-s9/1	VAP-C3	44,013	1,962	3,8	2,5	60	0,0091	5,80	1,00	300	1,5283	0,9717	0,2000	Flare	0	0,3	2,5000	1,7283	554	558	heated	Not Req	40	2,4	0,01	52	0,03	9687,91	-39	
AE7201-s9/2	VAP-C3	44,013	1,962	3,8	2,5	60	0,0091	5,80	1,00	300	1,5283	0,9717	0,2000	Flare	0	0,3	2,5000	1,7283	554	558	heated	Not Req	40	5,35	0,01	52	0,03	9687,91	-39	

LINES

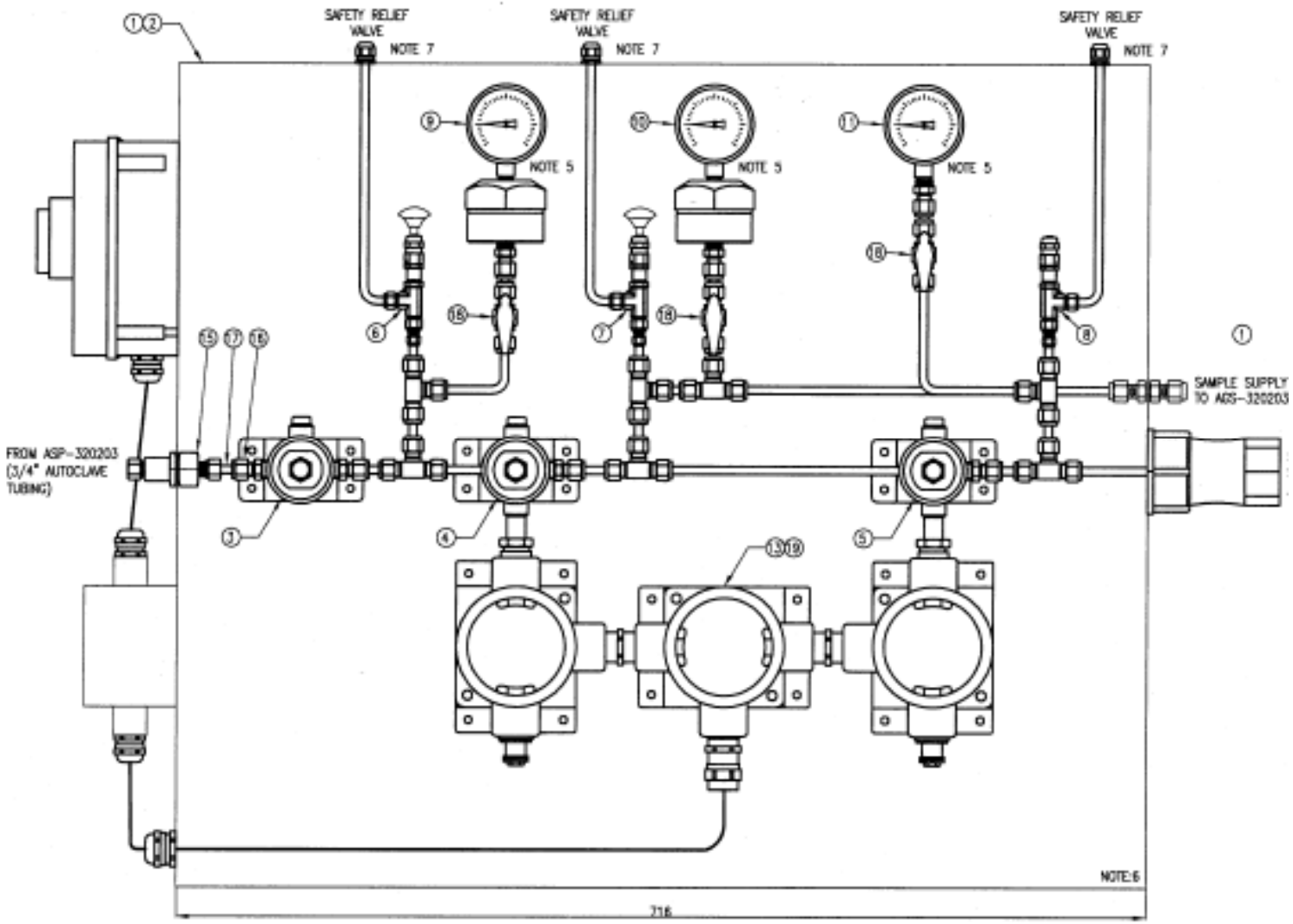
Internal diameter feed line	4	6 x 4 mm tubing with 1 mm wall thickness

Transfer Time Acceptable values =	60 sec. for GC's having cycle time of UP TO 5 minutes
	90 sec. for GC's having cycle time of 5 TO 10 minutes

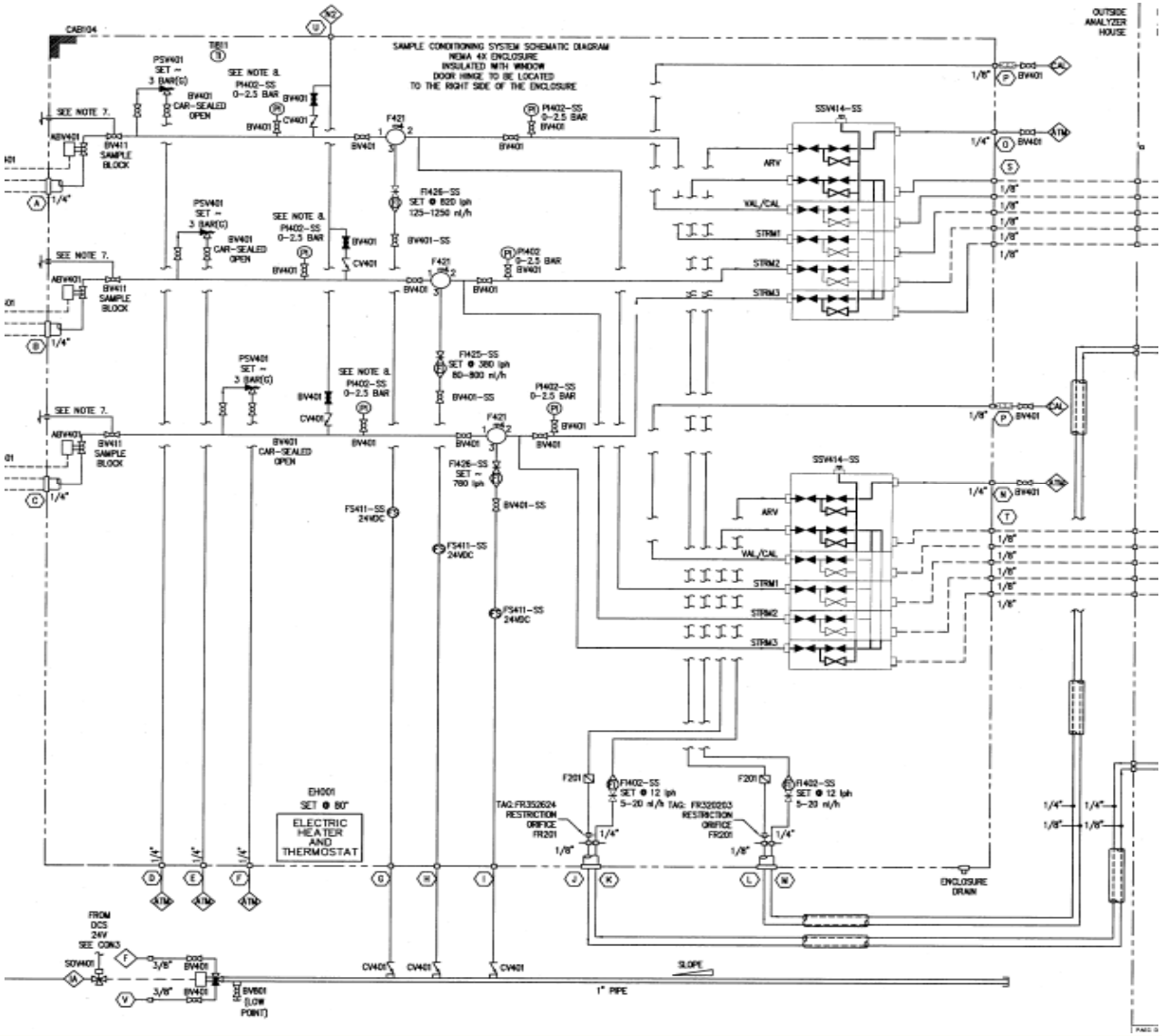
Pressure Reducing Station - Layout



STAZIONE DI RIDUZIONE PRESSIONE



3 STREAM RIDONDANTI



Alcune note sui materiali

- H2S utilizzo di coating (sulfinert)
- HCl e campioni corrosivi
- Campioni ad alta temperatura
- NACE requisiti

Sistemi speciali: sparging