Annexure-IX

FY2010-11

Supply	Flow
	MSM3/D
CHAINSA	8.252086

Deliveries	Flow
	MSM3/D
HERO MOTO	0.346
KAJARIA	1.4013
MSIL	2.941
OMAX AUTO	0.346
HNG-2	0.6055
Uttam Strip	0.173
Indo Alusys	0.0865
Dakshin	0.2422
FCC Clutch	0.5882
USG Boral	0.173
Parle Biscuit	0.1384
Rathi Bar	0.2595
Rathi Steel	0.9515

FY2011-12

Supply	Flow
	MSM3/D
CHAINSA	8.295

Deliveries	Flow
	MSM3/D
HERO MOTO	0.29
KAJARIA	0.92
MSIL	2.83
MANESAR-OTHERS	0.115
OMAX AUTO	0.115
HNG-2	0.345
Sharp Menthol	0.115
Uttam Strip	0.115
Dakshin	0.23
USG Boral	0.115
Parle Biscuit	1.61
Rathi Bar	0.23
Rathi Steel	0.69
RICO	0.23
Rathi Saria	0.345

FY2012-13

Supply	Flow
	MSM3/D
CHAINSA	8.6190017

Deliveries	Flow
	MSM3/D
HERO MOTO	0.5185
KAJARIA	0.7225
MSIL	2.941
MANESAR-OTHERS	0.1275
OMAX AUTO	0.17
CAPARO POWER	0.7225
HONDA CAR	0.0255
HNG-2	0.2975
SANDEN	0.0255
Richfield	0.034
HSIL-2	0.0085
Sharp Menthol	0.0595
Mica II	0.0085
Shan Tableware	0.017
Pelican Ceramics	0.0085
Feather touch	0.017
Uttam Strip	0.085
AMTEK II	0.0255
MICA-1	0.0255
KEI	0.017
Indo Alusys	0.0425
Continental Engine	0.0255
Arvind Press Caps	0.017
AV Infra	0.085
Dakshin	0.1445
Century	0.0255
HMSIL	0.2635
USG Boral	0.1445
Parle Biscuit	0.969
Rathi Bar	0.1275
Rathi Steel	0.5015
Hero Moto-1	0.034
RICO	0.204
Rathi Saria	0.1785

FY2013-14

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.579996

Deliveries	Flow
	MSM3/D
HERO MOTO	0.8235
KAJARIA	1.107
MSIL	4.7115
MANESAR-OTHERS	0.2025
OMAX AUTO	0.27
CAPARO POWER	1.593
HONDA CAR	0.1215
HNG-2	0.4725
SANDEN	0.0405
Richfield	0.054
Toyoda	0.0135
HSIL-2	0.0135
SAINT GOBAIN	1.242
Sharp Menthol	0.108
Mica II	0.0135
Shan Tableware	0.027
Pelican Ceramics	0.054
Feather touch	0.027
Uttam Strip	0.135
AMTEK II	0.0405
MICA-1	0.0405
KEI	0.027
Surya	0.0135
Indo Alusys	0.1215
Continental Engine	0.0405
Arvind Press Caps	0.027
AV Infra	0.135
Dakshin	0.189
Sunbeam	0.027
Century	0.135
HMSIL	0.729
USG Boral	0.2025
Parle Biscuit	0.108
Rathi Bar	0.2025
Rathi Steel	0.8235
IGP	0.0405
Hero Moto-1	0.054
Havell	0.054
RICO	0.324
Rathi Saria	0.216

FY2014-15

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.6795

Deliveries	Flow
	MSM3/D
HERO MOTO	0.36672386
KAJARIA	1.0631628
MSIL	3.9805251
CAPARO MARUTI	0.034500276
MANESAR-OTHERS	0.16674646
OMAX AUTO	0.22999795
CAPARO POWER	1.6927964
CMR NIKKEI	0.13376062
HONDA CAR	0.10354283
HNG-2	0.40243841
SANDEN	0.034612045
Richfield	1.0516248
Toyoda	0.012947459
HSIL-2	0.011439579
SAINT GOBAIN	1.0348294
Special Ceramics	0.017306028
Sharp Menthol	0.020317579
Mica II	0.013786154
Shan Tableware	0.028745596
Pelican Ceramics	0.50168487
Feather touch	0.030505533
Uttam Strip	0.11498241
AMTEK II	0.17862618
MICA-1	0.0378386
KEI	0.036904052
Surya	0.011439579
Indo Alusys	0.10354283
Continental Engine	0.034612045
Arvind Press Caps	0.020825891
AV Infra	0.064846913
Dakshin	0.15525
Sunbeam	0.122879
Century	0.068930782
Hema	0.014079473
HMSIL	0.62303534
FCC Clutch	0.040478494
USG Boral	0.1724736
Parle Biscuit	0.18596159
Rathi Bar	0.1725
Rathi Steel	0.6899912
IGP	0.31728204
Hero Moto-1	0.08066368
Havell	0.040478494
RICO	0.27603303
Rathi Saria	0.18391318

FY2015-16

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.7

Deliveries	Flow
	MSM3/D
HERO MOTO	0.454378935
KAJARIA	1.590417255
MSIL	3.930390307
CAPARO MARUTI	0.034078693
MANESAR-OTHERS	0.35901481
OMAX AUTO	0.227187448
CAPARO POWER	1.133110099
CMR NIKKEI	0.008287281
HONDA CAR	0.113594734
HNG-2	0.397520732
SANDEN	0.034189095
Richfield	0.050993914
Toyoda	0.011299791
HSIL-2	0
SAINT GOBAIN	1.674272466
Special Ceramics	0.096610868
Sharp Menthol	0.079456631
Mica II	0.013617691
Shan Tableware	0.028394333
Pelican Ceramics	0.046537161
Feather touch	0.030132764
Uttam Strip	0.113577358
AMTEK II	0.056482835
MICA-1	0.173689903
KEI	0.025207216
Surya	0.238489262
Indo Alusys	0.056788677
Continental Engine	0.147783825
Arvind Press Caps	0.022889316
AV Infra	0.015934388
Dakshin	0.153352891
Sunbeam	0.029415254
Century	0.068088468
Hema	0.799370349
HMSIL	0.485301168
FCC Clutch	0.097931485
USG Boral	0.21563356
Parle Biscuit	0.113464931
Rathi Bar	0.170392101
Rathi Steel	0.624771036
IGP	0.034189095
Hero Moto-1	0.079677993
Havell	0.039983858
RICO	0.272659988
Rathi Saria	0.18166581
Sant AL	0.011359473
Jhalani	0.159032627

FY2016-17

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.75

Deliveries	Flow
	MSM3/D
HERO MOTO	0.316857261
KAJARIA	1.690741508
MSIL	3.426088622
CAPARO MARUTI	0.012515739
MANESAR-OTHERS	0.403016197
OMAX AUTO	0
CAPARO POWER	1.239077036
CMR NIKKEI	0.020153555
HONDA CAR	0.100767327
HNG-2	0.347087459
SANDEN	0.020153465
Richfield	0.017841885
Toyoda	0.01119637
HSIL-2	0.01119637
SAINT GOBAIN	1.399380206
Special Ceramics	0.01119637
Sharp Menthol	0.011137544
Mica II	0.022275076
Shan Tableware	0.027986635
Pelican Ceramics	0.592492032
Feather touch	0.016794845
Uttam Strip	0.111946566
AMTEK II	0.026499925
MICA-1	0.156513856
KEI	0.036041652
Surya	0.235064933
Indo Alusys	0.06269967
Continental Engine	0.067178218
Arvind Press Caps	0.022560663
AV Infra	0.036892878
Dakshin	0.15115099
Sunbeam	0.028992898
Century	0.011137544
Hema	0.013707737
HMSIL	0.261193803
FCC Clutch	0.110804245
USG Boral	0.165697703
Parle Biscuit	0.119673215
Rathi Bar	0.167945545
Rathi Steel	0.61580033
IGP	0.017751183
Hero Moto-1	0.040357191
Havell	0.024079248
RICO	0.257548229
Rathi Saria	0
Sant AL	0.013422163
Jhalani	0.188748643
NHK Spring	0.100767327
Rockman	0.078374587
Ahresty	0.033589109
Wanfeng	0.31349835
Minda	0.167945545
Agrawal Metal	0.033589109
AURONEXT	0.01119637
JJF Casting	0.022392739
Mehru	0.078374587
RSGL	0.111963696
SPOT Customers	1.153226073

FY2017-18

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.75

Deliveries	Flow
	MSM3/D
HERO MOTO	0.316596043
KAJARIA	1.689347657
MSIL	3.423264147
CAPARO MARUTI	0.012505421
MANESAR-OTHERS	0.40268395
OMAX AUTO	0
CAPARO POWER	1.238055538
CMR NIKKEI	0.020136941
HONDA CAR	0.100684254
HNG-2	0.348031904
SANDEN	0.020136851
Richfield	0.017827176
Toyoda	0.014543281
HSIL-2	0.011128362
SAINT GOBAIN	1.398226554
Special Ceramics	0.011187139
Sharp Menthol	0.011128362
Mica II	0.022256713
Shan Tableware	0.027963563
Pelican Ceramics	0.59200358
Feather touch	0.016781
Uttam Strip	0.111854277
AMTEK II	0.026478079
MICA-1	0.156384826
KEI	0.036011939
Surya	0.234871145
Indo Alusys	0.06264798
Continental Engine	0.067123977
Arvind Press Caps	0.022542064
AV Infra	0.036862463
Dakshin	0.151026381
Sunbeam	0.028968996
Century	0.011128362
Hema	0.013696437
HMSIL	0.260978474
FCC Clutch	0.110712898
USG Boral	0.165561101
Parle Biscuit	0.119574556
Rathi Bar	0.16780709
Rathi Steel	0.615292663
IGP	0.017736549
Hero Moto-1	0.040323921
Havell	0.024059397
RICO	0.257335905
Rathi Saria	0
Sant AL	0.013411098
Jhalani	0.188593038
NHK Spring	0.106277734
Rockman	0.079782527
Ahresty	0.031324057
Wanfeng	0.313240533
Minda	0.16780844
Agrawal Metal	0.033385075
AURONEXT	0.015693844
JJF Casting	0.024706696
Mehru	0.073065042
RSGL	0.111852956
SPOT Customers	1.153159475

FY2018-19

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	14.78

Deliveries	Flow
	MSM3/D
HERO MOTO	0.331705595
KAJARIA	2.062794169
MSIL	3.586566745
CAPARO MARUTI	0.0103658
MANESAR-OTHERS	0.103657998
CAPARO POWER	1.96950197
HONDA CAR	0.124389598
rockman	0.093292199
HNG-2	0.362802994
SANDEN	0.0310974
Richfield	0.041463199
Nippon steel	0.041463199
Toyoda	0.0103658
Mikuni	0.0310974
HSIL-2	0.0103658
SAINT GOBAIN	2.342670764
Special Ceramics	0.0207316
Shiva Stainless Steel	0.0103658
Sharp Menthol	0.0103658
Mica II	0.0207316
Shan Tableware	0.0310974
Pelican Ceramics	0.0207316
Feather touch	0.0207316
Uttam Strip	0.103657998
AMTEK II	0.041463199
MICA-1	0.041463199
KEI	0.051828999
Surya	0.0103658
JJF Casting	0.0207316
Indo Alusys	0.062194799
Continental Engine	0.082926399
Arvind Press Caps	0.0207316
Sant Al	0.0207316
AURONEXT	0.041463199
Agrawal Metal	0.072560599
Orient Ceramics	0.0103658
Matod	0.041463199
Murti Udyog	0.0103658
AJANTA chem	0.0310974
APM	0.051828999
RELAXO	0.0207316
Mehru	0.0103658
Jaguar	0.051828999
RSGL Neemrana	0.238413396
Siddhi	0.0103658
AV Infra	0.051828999
Dakshin	0.134755398
Sunbeam	0.0207316
Century	0.103657998
Ajanta Soya	0.041463199
Sant AL 2	0.051828999
Hema	0.0207316
HMSIL	0.155486998
Jhalani	0.0310974
Ahresty	0.0310974
Adani IGL	0.134755398
FCC Clutch	0.103657998
USG Boral	0.155486998
Parle Biscuit	0.082926399
Rathi Bar	0.155486998
Rathi Steel	0.051828999
Wanfeng	0.290242396
Minda K	0.155486998
asian color	0.155486998
IGP	0.0310974
Hero Moto-1	0.072560599
Havell	0.0310974
RICO	0.248779196
NHK Spring	0.103657998
Mehsana	0.0310974

FY2019-20

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	12.634

Deliveries	Flow
	MSM3/D
HERO MOTO	0.288
KAJARIA	1.8048
MSIL	0.36
SUZUKI MOTORCYCLE	0.2112
MANESAR-OTHERS	0.192
CAPARO POWER	0.672
HONDA CAR	0.3168
rockman	0.096
HNG-2	0.336
SANDEN	0.0192
Richfield	0.0384
Nippon steel	0.0384
Toyoda	0.0192
Mikuni	0.0384
HSIL-2	0.0096
SAINT GOBAIN	1.9488
Special Ceramics	0.0192
Shiva Stainless Steel	0.0096
Mica II	0.0192
Shan Tableware	0.0288
Pelican Ceramics	0.0192
Uttam Strip	0.096
AMTEK II	0.0288
MICA-1	0.0384
KEI	0.048
Surya	0.0096
JJF Casting	0.0288
Indo Alusys	0.0576
Continental Engine	0.096
Sant Al	0.0192
AURONEXT	0.048
Agrawal Metal	0.096
Orient Ceramics	0.0288
Matod	0.0576
RELAXO	0.048
Mehru	0.0192
Jaguar	0.048
RSGL Neemrana	0.3456
Siddhi	0.0096
Dakshin	0.0248
Sunbeam	0.0192
Century	0.096
Sant AL 2	0.048
Hema	0.0192
HMSIL	0.096
Jhalani	0.0192
HCGKPL	0.096
Adani IGL	3.072
FCC Clutch	0.096
USG Boral	0.144
Parle Biscuit	0.0768
Rathi Bar	0.144
Rathi Steel	0.048
Wanfeng	0.288
Minda K	0.192
asian color	0.096
IGP	0.0288
Hero Moto-1	0.1056
Havell	0.0288
RICO	0.192
NHK Spring	0.096

FY2020-21

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	12.73

Deliveries	Flow
	MSM3/D
HERO MOTO	0.206145098
KAJARIA	0.809022271
MSIL	0.645013749
CAPARO MARUTI	0.008834245
SUZUKI MOTORCYCLE	0.070011543
MANESAR-OTHERS	0.473226168
OMAX/RICO	0.064825502
CAPARO POWER	1.33929488
CMR NIKKEI	0.108906844
HONDA CAR/FCC clutch/BORAL	0.26059852
rockman/wanfeng/asian color/minda	0.739613605
HNG-2	0
SANDEN	0.016206376
RICHF/IGP/HERO MOTO/HAVELL-2	0.06355786
PARLE G/PARLE NEW	0.059639462
Nippon steel	0.025930201
Toyoda	0.01166859
Mikuni	0.023974941
Deliv0005	0
HSIL-2	0.00648255
SAINT GOBAIN	0.423310531
Special Ceramics	0.014909866
Shiva Stainless Steel	0.00648255
Sharp Menthol	0.00648255
Mica II	0.0129651
Shan Tableware	0.018151141
Pelican Ceramics	0.012896865
Feather touch	0.014261611
Uttam Strip	0.065473757
Amtek I	0
AMTEK II	0.019447651
MICA-1	0.022688926
KEI	0.0324075
Surya Irrigation	0.00388953
JJF Casting	0.032412751
Indo Alusys	0.035654026
Continental Engine	0.051860402
Arvind Press Caps	0.013613356
Sant Al	0.032412751
AURONEXT	0.064825502
Agrawal Metal	0.048619127
Orient Ceramics	0.058342952
Matod	0.039543556
Murti Udyog	0.009723825
AJANTA chem	0.064825502
APM	0.032412751
RELAXO	0.023337181
Mehru	0.00907557
Jaguar	0.0324075
RSGL Neemrana	0.154284696
Siddhi	0.007130805
AV Infra	0.028523221
RathiBar/Specia/Dakshin	0
Century+Sunbeam	0.01037208
Century	0
Ajanta Soya	0.020744161
Sant AL 2	0.0129651
Hema	0.009755318
HMSIL	0.070659798
Jhalani	0.025936483
Ahresty	0.014909866
IGL Sakatpur	0.741603748
IGL Rewari	1.863733195
IGL Ajmer	0.005834295
IGL Bhiwadi	0.703356702
HCGKPL	0.044081342
Adani IGL	0.117334159
Adani Mahendragarh	0.27356362
Deliv0027	2.489856188

FY2021-22

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	12.73

Deliveries	Flow
	MSM3/D
HERO MOTO	0.206145098
KAJARIA	0.809022271
MSIL	0.645013749
CAPARO MARUTI	0.008834245
SUZUKI MOTORCYCLE	0.070011543
MANESAR-OTHERS	0.473226168
OMAX/RICO	0.064825502
CAPARO POWER	1.33929488
CMR NIKKEI	0.108906844
HONDA CAR/FCC clutch/BORAL	0.26059852
rockman/wanfeng/asian color/minda	0.739613605
HNG-2	0
SANDEN	0.016206376
RICHF/IGP/HERO MOTO/HAVELL-2	0.06355786
PARLE G/PARLE NEW	0.059639462
Nippon steel	0.025930201
Toyoda	0.01166859
Mikuni	0.023974941
Deliv0005	0
HSIL-2	0.00648255
SAINT GOBAIN	0.423310531
Special Ceramics	0.014909866
Shiva Stainless Steel	0.00648255
Sharp Menthol	0.00648255
Mica II	0.0129651
Shan Tableware	0.018151141
Pelican Ceramics	0.012896865
Feather touch	0.014261611
Uttam Strip	0.065473757
Amtek I	0
AMTEK II	0.019447651
MICA-1	0.022688926
KEI	0.0324075
Surya Irrigation	0.00388953
JJF Casting	0.032412751
Indo Alusys	0.035654026
Continental Engine	0.051860402
Arvind Press Caps	0.013613356
Sant Al	0.032412751
AURONEXT	0.064825502
Agrawal Metal	0.048619127
Orient Ceramics	0.058342952
Matod	0.039543556
Murti Udyog	0.009723825
AJANTA chem	0.064825502
APM	0.032412751
RELAXO	0.023337181
Mehru	0.00907557
Jaguar	0.0324075
RSGL Neemrana	0.154284696
Siddhi	0.007130805
AV Infra	0.028523221
RathiBar/Specia/Dakshin	0
Century+Sunbeam	0.01037208
Century	0
Ajanta Soya	0.020744161
Sant AL 2	0.0129651
Hema	0.009755318
HMSIL	0.070659798
Jhalani	0.025936483
Ahresty	0.014909866
IGL Sakatpur	0.741603748
IGL Rewari	1.863733195
IGL Ajmer	0.005834295
IGL Bhiwadi	0.703356702
HCGKPL	0.044081342
Adani IGL	0.117334159
Adani Mahendragarh	0.27356362
Deliv0027	2.489856188

FY2022-23

Supply	Flow
	MSM3/D
CHAINSA COMPRESSOR OUT	13.2

Deliveries	Flow
	MSM3/D
HERO MOTO	0.221996832
KAJARIA	1.500668342
MSIL	0.938575545
SUZUKI MOTORCYCLE	0.075493894
MANESAR-OTHERS	0.139557832
CAPARO POWER	1.441846002
HONDA CAR	0.084799733
rockman	0.13272543
HNG-2	0.244188824
SANDEN	0.021631718
Richfield	0.027942967
Nippon steel	0.027942967
Toyoda	0.012458648
Mikuni	0.025807205
HSIL-2	0.006941248
SAINT GOBAIN	0.967276787
Special Ceramics	0.023521395
Shiva Stainless Steel	0.007485754
Mica II	0
Shan Tableware	0.019577877
Pelican Ceramics	0.013882497
Uttam Strip	0.080571318
AMTEK II	0.020895095
MICA-1	0
KEI	0.036361746
Surya	0.006941228
JJF Casting	0.034889868
Indo Alusys	0
Continental Engine	0.056050035
Sant Al	0.034884216
AURONEXT	0
Agrawal Metal	0.062801762
Orient Ceramics	0
Matod	0.057412066
RELAXO	0.034889868
Mehru	0.009788939
Jaguar	0.041867841
RSGL Neemrana	0
Siddhi	0.007883373
Dakshin	0
Sunbeam	0.01133913
Century	0
Sant AL 2	0.013882497
Hema	0.010500859
HMSIL	0.088491283
Jhalani	0.035066794
HCGKPL	0.047416684
Adani IGL	0.126593943
FCC Clutch	0.084244621
USG Boral	0
Parle Biscuit	0.066988546
Rathi Bar	0
Rathi Steel	0
Wanfeng	0.195383097
Minda K	0.172895217
asian color	0.55264597
IGP	0.018580732
Hero Moto-1	0.02794289
Havell	0.020823683
RICO	0.069779805
NHK Spring	0.066290505
Ahresty	0.016049339
CAPARO MARUTI	0.01325815
CMR NIKKEI	0.117229956
IGL Sakatpur	0.798280176
IGL Rewari	0.610572687
Arvind Press Caps	0.014653744
AV Infra	0.034889868
Feather touch	0.015351542
Murti Udyog	0.009769163
AJANTA chem	0.069779736
APM	0.034889868
Ajanta Soya	0.069081938
Sharp Menthol	0.013955947
HCGDL	1.312556828
Adani Nuh Palwal	0.329360352
Mehsana	0.028609692
IGX	0.267256388
Knauf	0.120021145
Eugia	0.069779736
RHI Mag	0.062801762
Honda Motorcycle	0.06070837
Jindal Al	0.07396652
Torrent Neemrana	1.032042291

FY2010-11

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2011-12

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2012-13

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2013-14

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2014-15

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2015-16

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2016-17

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	Fluid													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2017-18

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2018-19

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2019-20

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2020-21

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

FY2021-22

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	4.163857	89.90851	4.951...	0.8501751	0.03620746	0.03280675	0.001210249		0.0004...				0.055811...
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

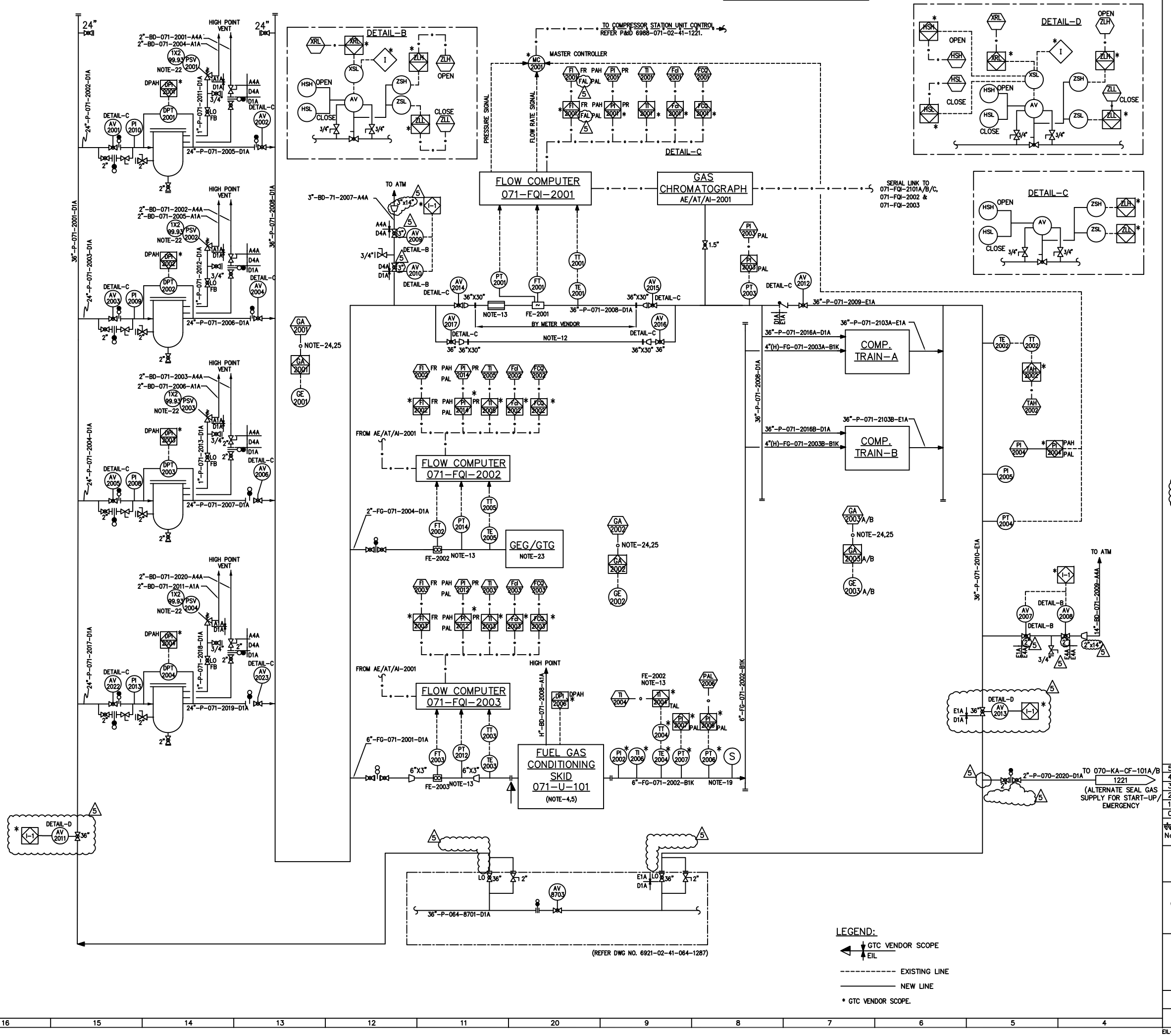
FY2022-23

	Name	Carbon Dioxide (CO2)	Methane (C1)	Ethane (C2)	Propane (C3)	Isobutane (IC4)	N-butane (NC4)	Isopentane (IC5)	N-pentane (NC5)	Hexane (C6)	Heptane (C7)	Heptane+ (C7+)	Octane (C8)	Nitrogen (N2)
Init...	**Fluid**													
Units		*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*	*percent*
0001	CJHPL	0.5956	96.5222	1.8186	0.4596	0.0977	0.1007	0.0473	0.0324	0.0664				0.2595
0002	CJHPL-SNPL	2.650469	92.02229	4.470...	0.6401133	0.02900513	0.01730306							0.1700301
0003	Spot Gas		92.79	5.41	1.37	0.32								0.11
New														

F69881220

071-GN-CT-101 A/B/C/D
GAS FILTERS

071-KA-CF-101 A/B
GAS TURBINE COMPRESSORS



LEGEND:

GTC VENDOR SCOPE / EIL

---------- EXISTING LINE

———— NEW LINE

* GTC VENDOR SCOPE.

NOTES:

1. SAFETY VALVE TO BE LOCALLY VENTED AT SAFE ELEVATION. VENTS FROM DEPRESSURISING LINES TO BE IN A SAFE AREA 20M AWAY FROM COMPRESSOR STATION AND AT AN ELEVATION NOT LESS THAN 3M ABOVE THE HIGHEST OPERATING LEVEL IN THE COMPRESSOR STATION. ALL VENT LINES TO HAVE RAIN CAP AT TOP AND DRAIN AT BOTTOM.
2. ALL INSTRUMENT TAG NOS. SHALL BE PROCEDED BY UNIT NO. 071 I.E. TI-2001 SHALL BE READ AS 071-TI-2001.
3. ALL THE INDICATIONS/RECORDINGS OF INSTRUMENTS SHOWN IN THIS P&ID SHALL BE ON PLC. PANEL MOUNTED INSTRUMENTS WILL BE IN STATION COMMON PANEL.
4. TO BE SUPPLIED BY GTC VENDOR AND SHALL BE DESIGNED FOR COMPR. CONFIGURATION (1+1) CONSIDERING THE TOTAL FUEL GAS REQUIREMENT. VENDOR TO PROVIDE FLOW MEASUREMENT FOR COMMON FUEL GAS LINE GOING TO FUEL GAS CONDITIONING SYSTEM. FUEL GAS FLOW INDICATION TO BE PROVIDED IN THE CONTROL ROOM.
5. DPT-2006 TO BE SUPPLIED BY GTC VENDOR.
6. MASTER CONTROL IS FUNCTIONALLY SHOWN & INDICATIVE ONLY. FINAL SCHEME SHALL BE IMPLEMENTED AS PER SPECIFICATION BY COMPRESSOR VENDOR.
7. ESD BUTTON SHALL BE PROVIDED IN (SCADA) MCC, STATION COMMON PANEL.
8. REFER P&ID 6988-071-02-41-1221 FOR TYPICAL DETAILS OF COMPRESSOR TRAIN.
9. DELETED.
10.

INTERLOCK No.:	ACTUATED BY	ACTION
STATION ESD (071-I-1)	ESD PUSH BUTTON ON SCADA/ STATION COMMON PANEL	TRIP THE COMPR. TRAINS 071-KA-CF-101 A/B OPEN 071-AV-2007 071-AV-2008 071-AV-2009 071-AV-2010 AFTER ENSURING CLOSURE OF VALVES 071-AV-2011 071-AV-2013

ESD LOGIC SHOULD NOT RESET UNTILL AND UNLESS ALL DESIRED ACTIONS ARE ACHIEVED.

11. REFER LEGEND P&ID 6988-00-02-1201 FOR TYPICAL VALVES DETAIL.
12. PROVISION OF BYPASS LINE WITH SPOOL PIECE FOR INSTALLATION OF FLOW METER DURING CALIBRATION..
13. STRAIGHT LENGTH AS PER INSTRUMENTION REQUIREMENT.
14. FLOW COMPENSATION SHOULD BE DONE IN FLOW COMPUTER.
15. ANTI SURGE CONTROL, PERFORMANCE CONTROL AND MASTER CONTROL FUNCTIONALLY SHOWN AND INDICATIVE ONLY. FINAL SCHEME SHALL BE IMPLEMENTED AS PER SPECIFICATION BY COMPRESSOR VENDOR.
16. SIGNAL TO SCADA SHALL BE THROUGH SEPARATE SERIAL LINK FROM STATION PLC & EACH TRAIN UCP.
17. COMPRESSOR STATION INLET & OUTLET CONNECTION TO BE TAKEN FROM PROVISION KEPT FOR FUTURE COMPRESSOR UNDER VDBPL L PROJECT. (5)
18. ALL INDICATIONS, RECORDING OF INSTRUMENTS, STATUS, CONTROLS & ALARMS INDICATED IN THE P&ID SHALL BE IN COMMON FACILITY CONTROL PLC/PANEL. THE COMMON FACILITY PLC AND PANEL IS IN GTC PACKAGE VENDOR'S SCOPE.
19. FOR SAMPLE CONNECTION DETAILS REFER P&ID NO. 6921-02-41-00-1202.
20. HOOK UP TO BE TAKEN FROM SUCTION HEADER END FLANGE OF GREP COMPRESSORS.
21. HOOK UP TO BE TAKEN AT END FLANGE OF GREP KAILARAS COMPRESSOR DISCHARGE HEADER.
22. FIRE CASE PSV ON GAS FILTER TO BE PROVIDED BY FILTER VENDOR.
23. GEG/GTG PACKAGE TO BE SUPPLIED BY VENDOR. VENDOR DRAWINGS SHALL BE REFFERED FOR DETAILS.
24. HYDROCARBON DETECTORS SHALL BE PROVIDED FOR ALARM AT SUITABLE STRATEGIC LOCATIONS TO MONITOR THE LEAKAGE OF FAILURE PRONE EQUIPMENT PARTS, ACCESSORIES, VALVES & PIPES DEPENDING UPON THE WIND DIRECTION AND GAS DENSITY.
25. GAS DETECTORS ARE TO BE PROVIDED AT DOWN WIND DIRECTIONS NEAR FILTERS, FLOW METERS, COMPRESSOR, & FGC SKID. ALARM SIGNAL FROM GAS DETECTOR WILL BE TAKEN TO SMCS AND CONTROL ROOM.

No.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
5	10.11.10	REVISED AS PER HAZOP RECOMMANDATIONS & DCNs	नत्र्य			
4	25.08.10	REVISED AS MARKED	नत्र्य			
3	30.12.09	REVISED AS MARKED	GYAN	MS	MKA	AS
2	16.9.09	REVISED AS MARKED	GYAN	MS	MKA	AS
1	24.7.09	REVISED AS MARKED	GYAN	MKA	AS	AS
0	30.01.09	ISSUED FOR COMMENTS/ENGINEERING	BRD	MKA	AS	AS

इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम)
ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

गैस अथॉरिटी आफ इन्डिया लिमिटेड
GAS AUTHORITY OF INDIA LIMITED

COMPRESSOR STATION WORKS AT KAILARAS AND CHAINSA

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
CHAINSA COMPRESSOR STATION

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो. REV.
NTS	6988	02	41	071	1220	5

EIL-0241-502-REV-0-A
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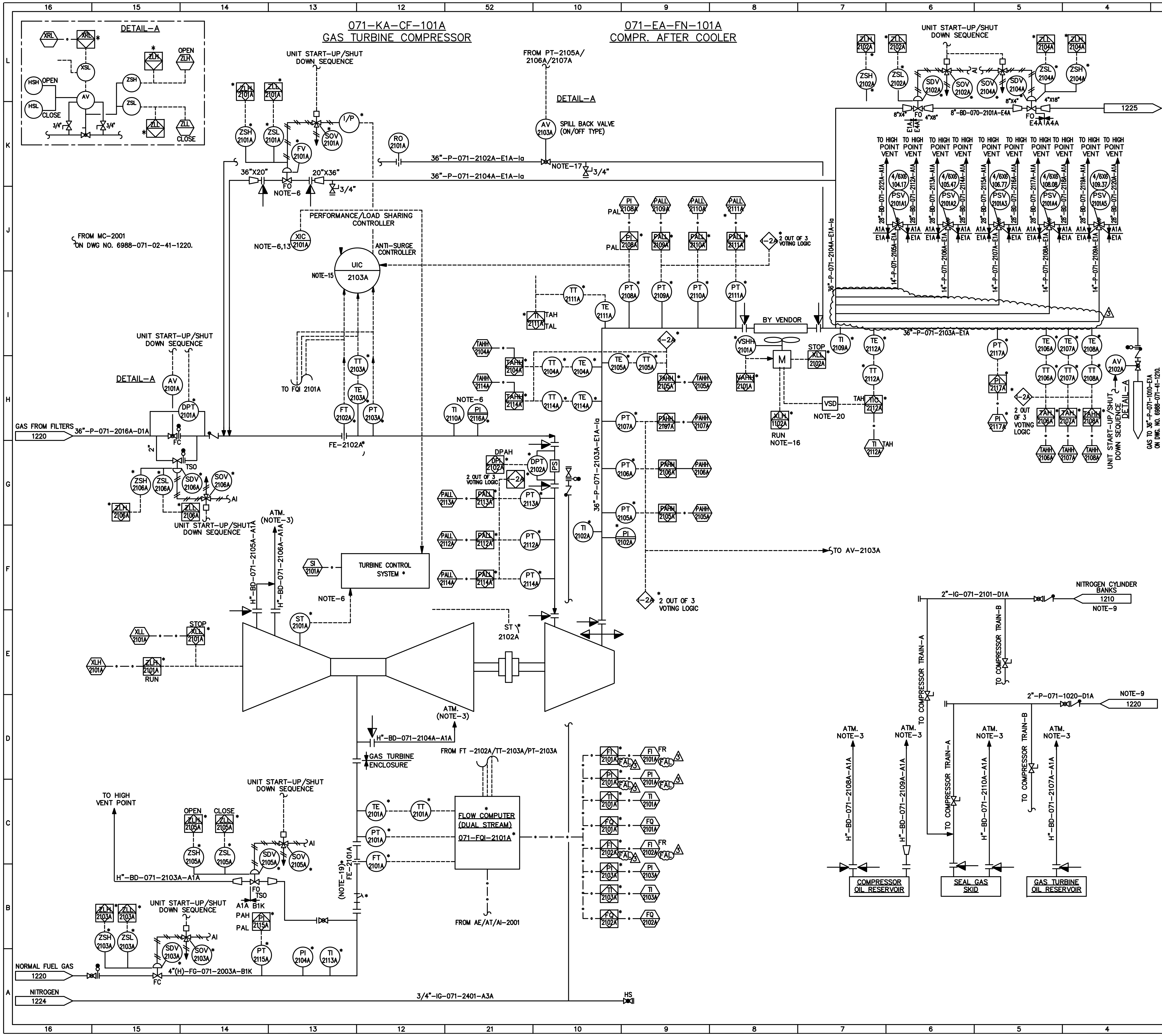


NOTES:

1. THIS DRAWING SHOWS ONLY PROCESS INSTRUMENTATION. ALL INSTRUMENT MEASUREMENT REQUIRED FROM MACHINERY POINT OF VIEW ARE TO BE DETAILED BY VENDOR.
2. COMORESSOR TO HAVE FACILITY FOR START/STOP FROM SCADA CONTROL CENTER.
3. SAFETY VALVE TO BE LOCALLY VENTED AT SAFE ELEVATION. VENTS FROM DEPRESSURISING LINES TO SEPARETELY VENTED IN SAFE AREA AT A HEIGHT NOT LESS THAN 3M ABOVE THE HEIGHEST OPERATING PLATFORM IN THE COMPRESSOR STATION AREA. ALL VENT PIPES SHALL BE PROVIDED WITH RAIN CAPS CAPS ON TOP AND DRAIN ON BOTTOM.
4. COMMON TRIP ALARM FOR TRAINS TO BE TELEMETERED TO SCADA
5. EMERGENCY SHUT DOWN PUSH BUTTON FOR COMPR. TRAIN SHALL BE PROVIDED IN MCC, UCP, STATION COMMON PANEL & LOCAL AT EACH SKID.
6. TO BE SUPPLIED BY GTC VENDOR. INSTRUMENT MARKED WITH * ARE ALSO IN GTC VENDOR'S SCOPE.
7. ALL INSTRUMENT TAG NOs. SHALL BE PRECEDED BY UNIT NO-071, i.e. TI-2101 SHALL BE READ AS 071-TI-2101.
8. THIS P&ID INDICATES DETAILS OF A TYPICAL COMPRESSOR TRAIN. BOTH COMPRESSOR TRAINS ARE IDENTICAL EXCEPT INSTRUMENT AND PIPING SHALL HAVE SUFFIX A OR B RESPECTIVELY. E.G. PI-2102A SHALL BE READ AS PI-2102B FOR COMPRESSOR TRAIN "B".
9. NORMAL SEAL GAS SUPPLY WILL BE TAKEN FROM COMPRESSOR DISCHARGE. PROVISION FOR START-UP/EMERGENCY SEAL GAS SUPPLY IS TAKEN FROM LINE PACK OF 48" VDBPL PIPELINE AND NITROGEN CYLINDER BANKS. PROVISION FOR CHANGEOVER FROM NORMAL SEAL GAS SUPPLY TO EMERGENCY SEAL GAS SUPPLY IS UNDER GTC VENDOR'S SCOPE. VENDOR TO PROVIDE FLOW INDICATION AND ALARM IN SEAL GAS SUPPLY LINE. PRESSURE REDUCTION FACILITY, IF ANY REQUIRED IN SEAL GAS SYSTEM SHALL BE PROVIDED BY COMPRESSOR VENDOR.
10. ALL THE INDICATIONS, RECORDING OF INSTRUMENTS AND ALL ANNUNCIATORS INDICATED IN THIS P&ID SHALL BE IN UNIT CONTROL PANEL AND SHALL BE REPEATED IN GTC TRAIN PLC PLC IS IN GTC PACKAGE'S SCOPE.
11. ACOUSTIC INSULATION SHALL BE PROVIDED ON FOLLOWING LINES
    - COMPR. MIN. FLOW LINES AND SPILL BACK FLOW LINE.
    - COMPR. SUC. LINE FROM SUCTION VALVE TO SUCTION NOZZLE.
    - COMPR. DISCHARGE LINE FROM DISCHARGE NOZZLE TO AFTER COOLER.
12. FUEL GAS FLOW SHALL BE INTEGRATED FOR ALL COMPRESSOR TRAINS & SHALL BE TELEMETERED TO SCADA.
13. XIC TO BE PROVIDED BY VENDOR.
14. INTERLOCK No.: ACTUATED BY ACTION

    071-I-2A PT/PALL-2112A/13A/14A (2 OUT OF 3) PT/PALL-2109A/10A/11A (2 OUT OF 3) PT/PAHH-2105A/06A/07A (2 OUT OF 3) TT/TAHH-2104A/05A/10A (2 OUT OF 3) TT/TAHH-2106A/07A/08A (2 OUT OF 3) — OPEN 071-FV-2101A TRIP 071-KA-CF-101A.

    PROVIDE TRIP BYPASS FOR START UP FOR PT/PALL-2114A/2112A/2113A. FOR TRAIN B ABOVE, INTERLOCK LOGIC WILL HAVE SUFFIX B, I.E. 071-I-2B WOULD BE ACTUATED BY/ACTION UPON CORRESPONDING INSTRUMENTS WITH SUFFIX B.
15. VENDOR SHALL HAVE THE OPTION OF TAKING COMPENSATED OR UNCOMPENSATED FLOW FOR UNIT COMPRESSOR CONTROLLER.
16. TYPICAL INSTRUMENTATION FOR A COOLER FAN IS SHOWN.
17. AV-2103A IS A SPILL BACK VALVE ACTUATED BY SIGNAL FROM ATLEAST TWO OUT OF THREE PT/PAHH AT THE COMPRESSOR DISCHARGE. THE VALVE SHALL BE ON/OFF TYPE.
18. SIGNAL TO SCADA WILL BE BY SEPARATE SERIAL LINK FROM EACH PLC.
19. STRAIGHT LENGTH AS PER INSTRUMENTATION REQUIREMENT.
20. 50% OF FAN MOTORS IN COMPRESSOR AFTER COOLER SHALL BE PROVIDED WITH VARIABLE SPEED DRIVE (VSD) TO SAVE ENERGY & DISCHARGE TEMPERATURE WILL BE CONTROLLED THROUGH VSD.

LEGEND:-

GTC PACKAGE VENDOR / EIL

* GTC PACKAGE VENDOR'S SCOPE.

संख्या No.	तिथि DATE	संशोधन REVISIONS	ड्रॉन DRN	द्वारा BY	जाँच CHKD	अनुमोदित APPD.
3	10.11.10	REVISED AS PER HAZOP RECOMMANDATIONS & DCNs	नत्थू			
2	25.8.10	REVISED AS MARKED	नत्थू	MS	MKA	AS
1	24.7.09	REVISED AS MARKED	GYAN	MKA	AS	AS
0	30.01.09	ISSUED FOR COMMENTS/ENGINEERING	BRD	MKA	AS	AS

इंजिनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम)
ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

गैस अथॉरिटी आफ इन्डिया लिमिटेड
GAS AUTHORITY OF INDIA LIMITED

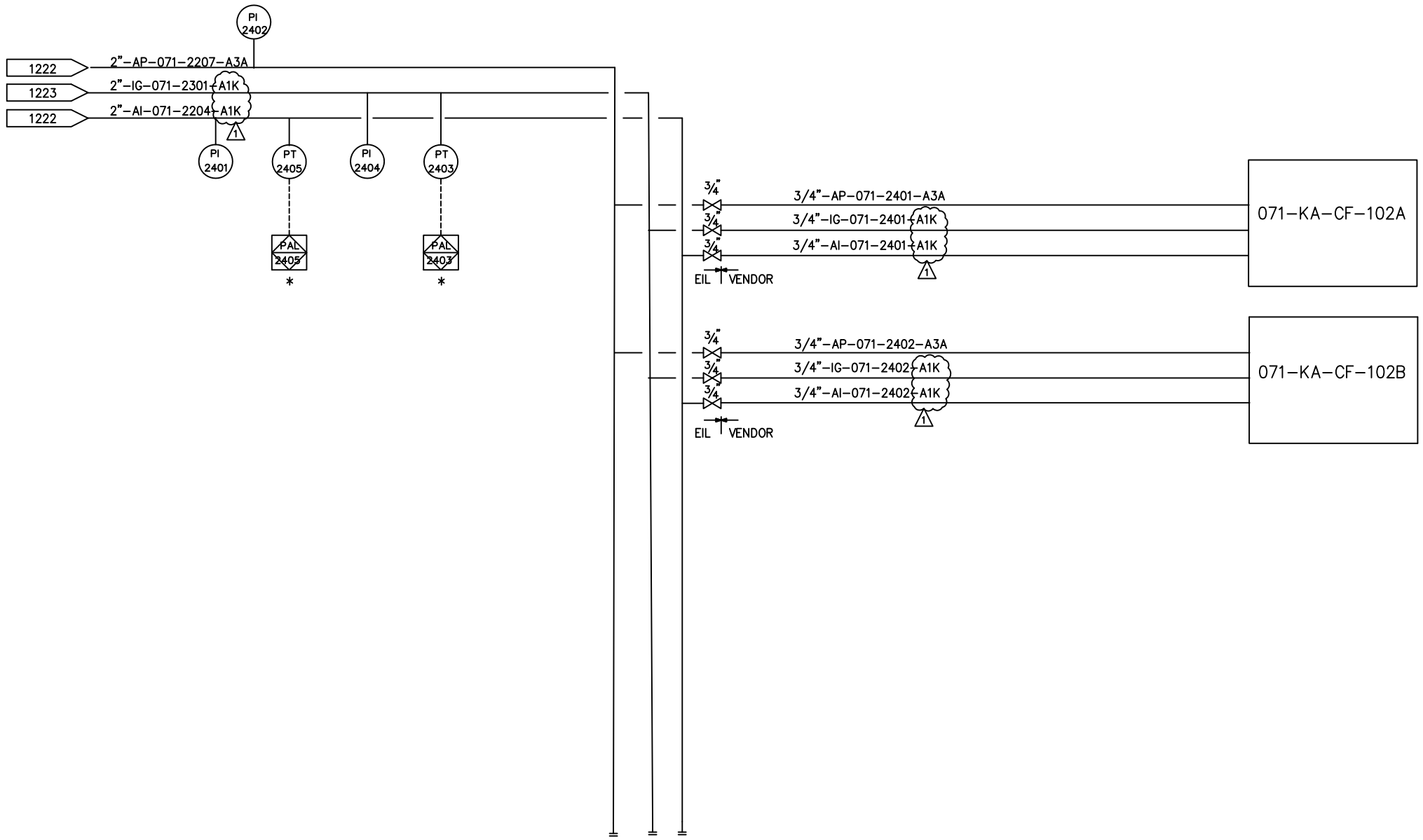
COMPRESSOR STATION WORKS AT KAILARAS AND CHAINSA

पाइपिंग एण्ड इंस्ट्रूमेंटेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
CHAINSA COMPRESSOR STATION
TYPICAL COMPRESSOR DETAILS FOR COMPRESSOR TRAIN'A'

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	संशो. REV.
∽	6988	02	41	071	1221	3

EIL-0241-502-REV-0-A DISTRIBUTION CODE

F69881224



NOTES:-

1. INSTRUMENT MARKED WITH '*' IS IN GTC VENDOR'S SCOPE

No.	DATE	REVISIONS	DRN	BY	CHKD	APPD.
1	10.11.10	REVISED AS PER HAZOP RECOMMANDATIONS & DCNs	नत्थू			
0	27.05.09	ISSUED FOR COMMENTS/ENGINEERING.	Js	MS	MKA	AS

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ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

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COMPRESSOR STATION WORKS AT KAILARAS AND CHAINSA

पाइपिंग एण्ड इंस्ट्रूमैन्टेशन डायाग्राम
PIPING AND INSTRUMENTATION DIAGRAM
UTILITY DISTRIBUTION AT CHINSA

SCALE	JOB NO.	DEPT.	SECTN.	UNIT	DWG. No.	REV.
NTS	6988	02	41	071	1224	1

EIL-0241-502-REV-0-A

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PROCESS DESIGN BASIS FOR PMC SERVICES FOR COMPRESSOR STATIONS WORKS AT KAILARAS AND CHAINSA FOR VIJAIPUR –DADRI PIPELINE PROJECT

APPROVED	
GAIL	**EIL**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
B	18.03.09	CLIENT'S INPUTS INCORPORATED &REISSUED FOR APPROVAL			
A	20.1.09	ISSUED FOR COMMENTS/APPROVAL	MKA	AS	AS

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1.0 INTRODUCTION:

GAIL (India) Limited, have awarded EIL the Project Management Consultancy Services for installation of new compressor stations and associated facilities in the proposed 48" Vijaipur –Dadri Pipeline being currently executed under Vijaipur-Dadri-Bawana Pipeline Project at Kailaras and Chainsa.

The project broadly covers installation of compressor stations at Kailaras (228.036 Kms) downstream of Vijaipur near 2nd Intermediate Pigging Station) and at Chainsa(457.049 Kms) downstream of Vijaipur near 4th Intermediate Pigging Station) on new 48" Vijaipur-Dadri pipeline.

This design basis covers the design parameters for compressor stations.

2.0 BASIC PARAMETERS

2.1	Products to be transported	Gas
2.2	Product properties/specifications	As per Annexure-I.
2.3	Design codes	Latest edition of ASME B31.8 and OISD-226 Guidelines will be followed as applicable. However, in case of contradictory stipulations, the more stringent conditions will prevail.
2.4	Total compression capacity required	KAILARAS : 53.4~~–~~75 MMSCMD CHAINSA : 53.~~1~~55 MMSCMD
2.5	Sparing philosophy for compressors	100% for Single compressors (1W+1S) 50% for two compressors (2W+1S) 33% for three compressors (3W+1S)
2.6	Type of compressor	Centrifugal
2.7	Type of driver	Gas Turbine
2.8	Type of intercooler and after cooler	Air cooler

3.0 PROJECT SCOPE AND BATTERY LIMITS

3.1 PROJECT SCOPE:

- Compressor Stations at Kailaras and Chainsa along with its auxiliaries, GTG/GEG/DEG etc.

3.2 BATTERY LIMITS :

3.2.1 Compressor Station at Kailaras : From/to existing 36" Tap-Offs provided at IPS-2 on 48" Vijaipur-Dadri pipeline.

3.2.2 Gas compositions : Annexure-I

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3.2.3	Compressor Station at Chainsa	:	From/to existing 36" Tap-Offs provided at IPS-4 on 48" Vijaipur-Dadri pipeline.
.			
3.2.4	Gas compositions	:	Annexure-I

4.0 PIPELINE PARAMETERS (UNDER EXECUTION)

4.1	Main pipeline diameter	:	48" NB
4.2	Pipeline Roughness	:	10 micron
4.3	Corrosion allowance	:	Nil
4.4	Subsoil temperature	:	20-25 deg. C (1 meter below surface)
4.5	Chainage of IPS-2 (Kailaras)	:	228.~~43~~036 km from Vijaipur
4.6	Chainage of IPS-4 (Chainsa)	:	~~456.7~~457.049 km from Vijaipur

5.0 COMPRESSOR STATION PARAMETERS

5.1 Kailaras Compressor Station

Compressor suction pressure	:	As per hydraulics
Compressor suction temperature	:	As per hydraulics
Compressor discharge pressure	:	99.93 kg/cm^2_g
Total flow rate	:	~~53.4~~53.75 MMSCMD
Configuration	:	2+1 (To be confirmed by compressor vendor)

5.2 Chainsa Compressor Station

Compressor suction pressure	:	As per hydraulics
Compressor suction temperature	:	As per hydraulics
Compressor discharge pressure	:	99.93 kg/cm^2_g

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Total flow rate : ~~53.15~~53.5 MMSCMD

Configuration : 2+1 (To be confirmed by compressor vendor)

5.3 Utility specification (At Kailaras Compressor station)

S.NO	Parameters	Plant Air	Instrument Air	Nitrogen	Service Water
5.3.1	Source	From. Air Compressor	From. Air Compressor	From PSA Unit	Borewell
5.3.2	Dew Point	—	-40^{0}C at atm. Pr.	—	—
5.3.3	Pressure, kg/cm^2_g (min/nor/design)	5.0/ 8.0 / 11.5	5.0/ 7.5 / 11.5	4.5	3.0
5.3.4	Temperature, ° C	55.0	55.0	Ambient	Ambient
5.3.5	Storage requirement	5 minutes hold-up	20 minutes hold-up	—	—
5.3.6	Consumption	Note:1	Note:1	Note:1	5 m^3/hr (intermittent)
5.3.7	Quality	Oil Free	Oil Free	99.5% pure	

Note 1: Data will be firmed-up after the requirement is finalized by Compressor/GTC vendors during detailed engineering.

5.4 Utility specification (At Chainsa Compressor station)

S.NO	Parameters	Plant Air	Instrument Air	Nitrogen	Service Water
5.4.1	Source	From. Air Compressor	From. Air Compressor	From PSA Unit	Borewell
5.4.2	Dew Point	—	-40^{0}C at atm. Pr.	—	—
5.4.3	Pressure, kg/cm^2_g (min/nor/design)	5.0/ 8.0 / 11.5	5.0/ 7.5 / 11.5	4.5	3.0
5.4.4	Temperature, ° C	55.0	55.0	Ambient	Ambient
5.4.5	Storage requirement	5 minutes hold-up	20 minutes hold-up	—	—
5.4.6	Consumption	Note:1	Note:1	Note:1	5 m^3/hr (intermittent)
5.4.7	Quality	Oil Free	Oil Free	99.5% pure	

Note 1: Data will be firmed-up after the requirement is finalized by Compressor/GTC vendors during detailed engineering.

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6.0 INSTRUMENTATION

6.1	General	Adequate instrumentation and control system will be provided for safe and efficient operation. The compressor station shall be monitored and controlled through Supervisory Control and Data Acquisition (SCADA) of DVBPL currently being executed which is designed for remote monitoring and control application. RTU/Flow computers shall be provided at compressor station for flow computation, signal transmission to SCADA and logic and control. All transmitters shall be smart transmitters.
6.2	Control Philosophy At Kailaras & Chainsa compressor stations	Two levels of controls viz. PLC & SCADA are envisaged. Individual compressor trains shall be operated from the respective unit PLC(only minimum critical parameters are available in Unit Control Panel (UCP)) Station facility and common equipment shall be operated from common PLC (only minimum critical parameters are available in Facility Control Panel (FCP)).
6.3	Compressor Control	CCC ~~or equivalent.~~
6.4	Interlock & Shut down	PLC based.
6.5	Safety valve isolation	Safety valve isolation will be provided wherever required These isolation valves should be locked open.
6.6	Block & by-pass valve for control valves	As per design.
6.7	Type of control	Electronic
6.8	Final control element	Gas/Instrument air actuated for control valves and line gas for AVs.

B

7.0 SCADA & TELECOMMUNICATION SYSTEM

SCADA and Telecommunication systems being provided for Vijaipur–Dadri-Bawana Pipeline Project shall be extended to include compressor stations to ensure effective and reliable control, management and supervision of the compressor stations from a centralized location using Remote Telemetry Units (RTU).

7.1 SCADA monitoring and control: The SCADA master control station (SMCS) shall be located **at NGMC, Noida.**

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8.0 METEOROLOGICAL DATA

Location	Ambient temp. ^{0}C		Design Rh	Altitude, M above MSL	Air temp. considered for air cooler design,deg.C
	Min.	Max.			
Kailaras	2	46	84%@45ºC	190.3	42
Chainsa	2	46	90%@35ºC	197.8	42

9.0 GENERAL PROJECT SPECIFICATIONS

9.1 Numbering system to be followed:

9.1.1	Equipments	As per EIL standard
9.1.2	Instruments	As per EIL standard
9.1.3	Drawings/Documents	As per EIL standard
9.1.4	Unit No.	Kailaras CS : 070 Chainsa CS : 071
9.1.5	P&ID No.	Kailaras CS : 1210 - 1219 Chainsa CS : 1220 - 1229

9.2 Units of Measurement: Metric, unless otherwise specified
Gas flow rate shall be in MMSCMD

10.0 SPECIAL CUSTOMER REQUIREMENTS

10.1 ~~Since the compressor stations are installed at almost equal distances the specifications for compressors (suction pressure and compression ratio) shall be kept same in order to have the advantage of common spares~~DELETED.

10.2 Line down stream of compressor station should be piggable.

10.3 ~~Vendor to check the compressors at Chainsa and Kailaras for flow rate of 60MMSCMD (Check Case) and furnish the maximum discharge pressure achievable at Kailaras and Chainsa and also ensure minimum discharge pressure of 92kg/cm2g at Chainsa by various options such as variation of speed, taking standby train in line and bypass of excess gas~~DELETED.~~.~~

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ANNEXURE I

COMPOSITIONS OF GAS

(A) Rich gas (W/O C2/C3 extraction at DAHEJ)

S.NO	Component	Gas Composition, Mol%
1	C1	92.49
2	C2	5.64
3	C3	1.41
4	IC4	0.20
5	NC4	0.15
6	IC5	---
7	NC5	0.01
8	C6	---
9	N_2	0.09
10	CO_2	----
11	H_2S	6ppmw
12	Total Sulfur	24ppmw
	Total	100

(B) **LEAN GAS (With C2/C3 extraction at Dahej)**

S.NO	Name	Mol %
1	C1	94.07
2	C2	4.59
3	C3	1.07
4	IC4	0.18
5	NC4	---
6	IC5	---
7	NC5	---
8	C6	---
9	N_2	0.09
10	CO_2	---

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11	H_2S	6 ppmw
12	Total Sulfur	24ppmw
	Total	100

Rich gas is mixture of Dahej RLNG + Spot LNG + Reliance gas .Lean gas is a mixture of gas after extraction of C2/C3 from RLNG at Dahej +Spot LNG + Reliance gas.

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COMPRESSOR
PROCESS DATA SHEET

Document No. 6988-071-02-DS-1501
Rev. No. 2

PROJECT	COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA	CLIENT	GAIL		
UNIT	CHAINSA COMPRESSOR STATION	JOB NO.	6988	UNIT NO.	071
ITEM NO.	071-KA-CF-101A/B/C	SERVICE	NATURAL GAS COMPRESSOR		
TYPE	CENTRIFUGAL	LOCATION	CHAINSA (UNDER ROOF)		
NUMBER OF COMPRESSORS REQUIRED		IN REGULAR USE	NOTE-1	AS SPARE	NOTE-1
LUBRICATING OR NON-LUBRICATING TYPE					
TYPE OF DRIVER	REGULAR COMPRESSOR	GAS TURBINE DRIVEN			
	SPARE COMPRESSOR	GAS TURBINE DRIVEN			
NUMBER OF STAGES		ONE			

PROPERTIES OF GAS (COMPOSITION AT SUCTION)

COMPOSITION MOLE %		RICH GAS	LEAN GAS(NOTE-28)
WATER VAPOUR		-	-
HYDROGEN		-	-
NITROGEN		0.09	0.09
OXYGEN		-	-
CARBON MONOXIDE		-	-
CARBON DIOXIDE		-	-
HYDROGEN SULPHIDE		6 PPMW	6 PPMW
METHANE		92.49	94.07
ETHYLENE		-	-
ETHANE		5.64	4.59
PROPYLENE		-	-
PROPANE		1.41	1.07
I-BUTANE		0.20	0.18
N-BUTANE		0.15	-
I-PENTANE		-	-
N-PENTANE		0.01	-
HAXANE PLUS	(AVERAGE M. WT.)	-	-
AMMONIA		-	-
HYDROGEN CHLORIDE		-	-
CHLORINE		-	-
INERTS	(AVERAGE M. WT.)		
AIR	(DRY BASIS)		
H2O		NIL	NIL
TOTAL SULFUR		24 PPMW	24 PPMW

FLOW RATE	(NORMAL)	NM3/HR	2109030 (NOTE-2)	2109030 (NOTE-2)
		KG/HR		
AVERAGE M. WT.			17.4	17.07
DENSITY		KG/M3	57.5 (2)	56.3 (2)
COMPRESSIBILITY FACTOR			0.872	0.877
RATIO OF SPECIFIC HEATS	(Cp/Cv)		1.28 (NOTE -18)	1.28 (NOTE -18)
CORROSIVE / EROSIVE ELEMENTS			NONE	NONE
PARTICLE SIZE OF EROSIVES (IF ANY)				
IS DESIGN FOR NACE CODE IS REQUIRED			NO	NO
RATING				
SUCTION			600#(NOTE-26)	600#(NOTE-26)
DISCHARGE			900# (2)	900# (2)
OPERATING CONDITIONS				
SUCTION PRESSURE		KG/CM2 G	74.1 (NOTE-3)	74.5 (NOTE-3)
SUCTION TEMPERATURE		DEG C	34.5	34.4
DISCHARGE PRESSURE		KG/CM2 G	99.93(NOTE-23)	99.93 (NOTE-23)
DISCHARGE TEMPERATURE		DEG C	61.3 (NOTE-7)	61.2 (NOTE-7)
COMPRESSION RATIO			1.344 (2)	1.337 (1)
AFTER COOLER BY VENDOR			YES (NOTE-21)	YES (NOTE-21)
MAX DISCH. TEMP AT AFTERCOOLER EXIT		DEG C	55	
CONDENSATE FROM INTERSTAGES			NIL	
REFERENCE P&ID NUMBER (IF ANY)			NOTE-8	

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2	24.02.2009	REVSED AS MARKED	MKA	AS	AS
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COMPRESSOR
PROCESS DATA SHEET

Document No. 6988-071-02-DS-1501
Rev. No. 2

PROJECT	COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA	CLIENT	GAIL
UNIT	CHAINSA COMPRESSOR STATION	JOB NO.	6988
UNIT NO.	071		
ITEM NO.	071-KA-CF-101A/B/C	SERVICE	NATURAL GAS COMPRESSOR

CAPACITY CONTROL					
MODE		AUTOMATIC			
RANGE FOR RECIPROCATING MACHINE (STEPS/STEPLESS)					
TYPE OF CONTROL		NOTE-8			
AUTO START / AUTO STOP REQUIREMENT					
MECHANICAL DATA		UPSTREAM		DOWNSTREAM	
DESIGN PRESSURE	KG/CM2 G	99.93		104.17 (NOTE - 15)	
DESIGN TEMPERATURE	DEG C	65.0		65.0 (NOTE - 16) / (NOTE -7,27)	
UTILITIES AVAILABLE					
COOLING MEDIUM					
TYPE		AIR COOLED			
		IN		OUT	MECH. DESIGN
TEMPERATURE	DEG C	2.0/46.0			
PRESSURE	KG/CM2 G				
STEAM					
		MINIMUM	NORMAL	MAXIMUM	MECH. DESIGN
TEMPERATURE	DEG C				
PRESSURE	KG/CM2 G				
EXHAUST PRESSURE	KG/CM2 G				
DEGREE OF SUPER HEAT	DEG C				
INSTRUMENT AIR					
PRESSURE	KG/CM2 G	5.0	7.5		10.5
FUEL GAS		NOTE-17			
TEMPERATURE	DEG C				
PRESSURE	KG/CM2 G				
EXHAUST PRESSURE	KG/CM2 G				
DEW POINT HC	DEG C				
WATER	DEG C				
NET HEATING VALUE	KCAL/KG				
NITROGEN					
PRESSURE	KG/CM2 G		4.5 (NOTE-25)		10.5
REFERENCE P&ID NUMBER (IF ANY)		NOTE-8			

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0	02.01.2009	ISSUED FOR COMMENTS/ENGINEERING	MKA	AS	AS

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PROJECT	COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA		CLIENT	GAIL	
UNIT	CHAINSA COMPRESSOR STATION		JOB NO.	6988	UNIT NO. 071
ITEM NO.	071-KA-CF-101A/B/C	SERVICE	NATURAL GAS COMPRESSOR		

NOTES:

1 NO. OF COMPRESSORS

IN REGULAR USE	SPARE
2	1

ABOVE CONFIGURATION IS TENTATIVE ONLY, COMPRESSOR VENDOR TO CONFIRM THE FINAL CONFIGURATION.
SPARING PHILOSOPHY SHALL BE ADOPTED KEEPING MINIMUM ONE THIRD OF THE GROSS CAPACITY AS SPARE MACHINE HAVING CAPACITY IDENTICAL TO REGULAR UNIT, SUBJECT TO MINIMUM OF ONE SPARE UNIT.

2 TOTAL FLOW RATE TO COMPRESSORS. INDIVIDUAL COMPRESSOR CAPACITY SHALL DEPEND ON CONFIGURATION.

3 SUCTION PRESSURE INDICATED IS AT THE SUCTION FLANGE OF THE COMPRESSOR.TEMPORARY STRIANER SHALL BE IN SUCTION LINE DURING START UP AND THE SAME SHALL BE REPLACED BY PERMANENT STRAINER SUBSEQUENTLY.
STRAINER PRESSURE DROP OF 0.1 KG/CM2 HAS BEEN CONSIDERED TO ARRIVE AT THE COMPRESSOR SUCTION PRESSURE.

4 VENDOR TO PROVIDE THE MESH SIZE AND THE PRESSURE DROP ACROSS THE PERMANENT STRAINER.

5 VENDOR SHALL SUPPLY PERFORMANCE CURVES FOR ALL CASES OF OPERATION.

6 VENDOR TO ALSO INCLUDE IN THE SCOPE OF SUPPLY ALL NORMAL INSTRUMENTATION AND CONTROL FOR EFFICIENT OPERATION, SHUTDOWN AND SAFETY REQUIREMENTS AND ESSENTIAL ACCESSORIES.

7 VENDOR TO CONFIRM THE COMPRESSOR DISCHARGE TEMPERATURE.

8 APART FROM THE VENDOR'S SCOPE OF SUPPLY AS PER P&ID NO. 6988-02-41-071-1220 & 1221,VENDOR SHALL SUPPLY ADDITIONAL INSTRUMENTATION, CONTROL & SHUTDOWN LOGIC DEVICES FOR SAFE AND EFFICIENT OPERATION OF MACHINE.

9 AUTOMATIC SPILL BACKS IS CONSIDERED FOR EACH COMPRESSOR.

10 COMPRESSOR WILL START FROM CONTROL PANEL LOCATED IN MAIN CONTROL ROOM, HOWEVER, START CLEARANCE FROM FIELD WILL BE PROVIDED.MONITORING & CONTROL OF THE COMPRESSOR STATION SHALL BE PERFORMED AT TWO LEVELS, VIZ. MASTER CONTROL CENTRE (SCADA) AND UNIT CONTROL PANEL (UCP)/ COMMON FACILITY PANEL (FCP).

11 VENDOR TO INDICATE UTILITY REQUIREMENT.

12 NORMAL SEAL GAS SUPPLY SHALL BE FROM COMPRESSOR DISCHARGE,HOWEVER, PROVISION FOR START-UP/EMERGENCY SEAL GAS FROM LINE PACK OF EXISTING HBJ PIPELINE SHALL BE MADE. PROVISION FOR CHANGE OVER FROM NORMAL TO EMERGENCY SEAL GAS SUPPLY & VIS-À-VIS IS UNDER GTC VENDOR'S SCOPE. VENDOR TO PROVIDE FLOW INDICATION AND ALARM IN SEAL GAS SUPPLY LINE.

13 VENDOR TO PROVIDE NECESSARY FILTER, ELECTRIC HEATER, PRESSURE REGULATOR, CONTROL VALVES ETC. FOR SEAL GAS SYSTEM.

14 ACCERSSORIES LIKE AFTERCOOLERS, INSTRUMENTATION AND CONTROL PANEL ARE IN VENDORS SCOPE OF SUPPLY.

15 PSV ON COMPRESSOR DISCHARGE SHALL BE SET AT 104.17 KG/CM2G.

16 DESIGN TEMPERATURE SPECIFIED IS FOR DOWNSTREAM OF AFTER COOLER.

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2	24.02.2009	REVISED AS MARKED	MKA	AS	AS
1	19.02.2009	REVISED AS PER CLIENT'S/ENGG. INPUTS	MKA	HKP	HKP
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PROJECT	COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA	CLIENT	GAIL
UNIT	CHAINSA COMPRESSOR STATION	JOB NO.	6988
UNIT NO.	071		
ITEM NO.	071-KA-CF-101A/B/C	SERVICE	NATURAL GAS COMPRESSOR

NOTES:

17 FUEL GAS SHALL BE TAKEN FROM COMPRESSOR INLET COMMON HEADER .

GAS COMPOSTION :-	COMPONENT	MOLE% (RICH GAS)	MOLE% (LEAN GAS, NOTE-28)
	METHANE	92.49	94.07
	ETHANE	5.64	4.59
	PROPANE	1.41	1.07
	I-BUTANE	0.2	0.18
	N-BUTANE	0.15	0.00
	N-PENTANE	0.01	0.00
	NITROGEN	0.09	0.09
	H2S	6 PPMW	6 PPMW
	TOTAL SULFUR	24 PPMW	24 PPMW
	TOTAL	**100.0**	**100.00**
	SUPPLY PRESSURE KG/CM2(G)	73.6	74.0
	SUPPLY TEMP. DEG. C	34.5	34.4
	LHV (KCAL/KG)=	11840	11860
	HC DEW POINT(DEG C)= AT SUCTION PRESSURE	< -46.0	< -46.0

1

18 C_p/C_V VALUE IS ESTIMATED FOR CALCUALTION PURPOSE.

19 NOTE - DELETED.

20 COMPRESSOR VENDOR TO FURNISH SETTLE OUT PR5ESSURE CALCULATION AND BLOW DOWN CALCULATIONS FOR REVIEW BY EIL.

21 FOR AFTER COOLER DATA SHEET, REFER DOC. NO. 6988-071-02-DS-1401

22 VENDOR TO PROVIDE MAX. RATE OF DEPRESSURISATION DURING COMPRESSOR TRIP/ESD.

23 DISCHARGE PRESSURE INDICATED IS AT THE COMPRESSOR DISCHARGE FLANGE.

24 NECESSARY PROVISION SHALL BE KEPT FOR WASTE HEAT RECOVERY FROM GT EXHAUST IN FUTURE.

25 VENDOR TO INDICATE NITROGEN REQUIREMENT FOR EACH COMPRESSOR.

26 INDICATED IS MINIMUM RATING. VENDOR TO CHECK AND CONFIRM THE SAME.

27 VENDOR TO COMPUTE DESIGN TEMPERATURE AT COMPRESSOR DISCHARGE FLANGE BASED ON THE GOVERNING CASE OF HIGHEST DISCHARGE TEMPERATURE.

28 COMPOSITION CONSIDERED AFTER C2 / C3 RECOVERY FROM EXISTING RLNG SUPPLY OF 12 MMSCMD FROM PLL.

29 START UP/ EMERGENCY SEAL GAS SUPPLY FROM EXISTING LINE PACK OF GREP PIPELINE IS CHARACTERIZED AS BELOW.

COMPONENTS	H20	N2	CO2	H2S	C1	C2	C3	I-C4	N-C4	I-C5	N-C5	C6	C7	MOL. WT.
RLNG+HP LEAN GAS EX LPG MOL %	NIL	0.13	1.4	NIL	91.80	2.34	4.07	0.14	0.1	0	0	0.00	0	18

PRESSURE HOLD KG/CM2 G. DEW POINT HOLD

TEMPERATURE HOLD KG/CM2 G.

30 DEW POINT OF NORMAL SEAL GAS SUPPLY SHALL BE AS INDICATED IN NOTE-17

31 NOTE -DELETED

Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By
2	24.02.2009	REVISED AS MARKED	MKA	AS	AS
1	19.02.2009	REVISED AS PER CLIENT'S/ENGG. INPUTS	MKA	HKP	HKP
0	02.01.2009	ISSUED FOR COMMENTS/ENGINEERING	MKA	AS	AS

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ENGINEERS INDIA LIMITED
NEW DELHI

6988 ITEM NO.

R-R proposal no. OG1331

REV

CENTRIFUGAL COMPRESSOR DATA SHEET (API 617-6TH) SI UNITS

REVISION NO. 0 DATE 6-Apr-08

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APPLICABLE TO: ● PROPOSAL ○ PURCHASE ○ AS BUILT

FOR EIL - GAIL PIPELINE EXPANSION PROJECT UNIT

SITE Chainsa Station SERIAL NO.

SERVICE Gas Transmission NO. REQUIRED 2

● CONTINUOUS ○ INTERMITTENT ○ STAND BY DRIVER TYPE (3.1.1) Gas Turbine

MANUFACTURER Rolls-Royce MODEL RFBB36 DRIVER ITEM NO.

NOTE: INFORMATION TO BE COMPLETED: ○ BY PURCHASER ☐ BY MANUFACTURER

OPERATING CONDITIONS

(ALL DATA ON PER UNIT BASIS)

	OTHER CONDITIONS (3.1.2)				
	Rich	Lean	C	D	E
○ GAS HANDLED (ALSO SEE PAGE 2)	Rich Gas	Lean Gas			
● nm³/h (1.013 BAR & 0 °C)	2109030	2109030			
● WEIGHT FLOW, kg/min	27340	26834			
INLET CONDITIONS					
● PRESSURE (kg/cm2g)	74.1	74.5			
● TEMPERATURE (°C)	34.5	34.4			
○ RELATIVE HUMIDITY %					
● MOLECULAR WEIGHT (Mw)	17.393	17.073			
● Cp/Cv (K_{AVG})	1.4496	1.4565			
■ COMPRESSIBILITY	0.8747	0.8803			
■ INLET VOLUME, (m³/s)	7.9589	7.9631			
DISCHARGE CONDITIONS					
■ PRESSURE (kg/cm2g)	99.93	99.93			
■ TEMPERATURE (°C)	59.03	58.68			
■ Cp/Cv (K_{AVG})	1.4496	1.4565			
■ COMPRESSIBILITY	0.888	0.8935			
■ FRICTION POWER (KW)	41.5	41.7			
■ kW REQUIRED (ALL LOSSES INCLUDED)	20943	20680			
■ SPEED (RPM)	4837	4850			
■ ESTIMATED SURGE RANGE, % (AT SPEED ABOVE)	22.5	22.6			
■ POLYTROPIC HEAD (kJ/kg)	39.802	40.044			
■ POLYTROPIC EFFICIENCY (%)	88.77	88.78			
● CERTIFIED POINT	NO	YES			
☐ PERFORMANCE CURVE NUMBER					

PROCESS CONTROL

METHOD ○ SUCTION THROTTLING ○ VARIABLE INLET GUIDE VANES (3.4.2.4) ● SPEED VARIATION ○ DISCHARGE BLOWOFF ● COOLED BYPASS

FROM ____ (BAR)(kPa abs) FROM 70 % FROM Discharge

TO ____ (BAR)(kPa abs) TO 105 % TO ____ TO Suction

SIGNAL ● SOURCE (3.4.2.1) Suction / Discharge Pressure, Flow

TYPE ● ELECTRONIC ○ PNEUMATIC ○ OTHER ____

RANGE 4 - 20 MA ____ (BAR)(kPa abs) ____

ANTI-SURGE BYPASS ○ MANUAL ● AUTOMATIC ○ NONE

REMARKS:

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OPERATING CONDITIONS (Continued) (3.1.2) (3.1.3)

GAS ANALYSIS: ○ MOL % ○	MW	NORMAL	OTHER CONDITIONS A	B	C	D	E	REMARKS: (2.11.1.3) (2.11.1.8)
	MW			Rich	Lean			
AIR	28.966							
OXYGEN	32.000							
NITROGEN	28.016			0.09	0.09			
WATER VAPOR	18.016			NIL	NIL			
CARBON MONOXIDE	28.010							
CARBON DIOXIDE	44.010							
HYDROGEN SULFIDE	34.076			6 PPMW	6 PPMW			(2.11.1.7)
HYDROGEN	2.016							
METHANE	16.042			92.49	94.07			
ETHYLENE	28.052							
ETHANE	30.068			5.64	4.59			
PROPYLENE	42.078							
PROPANE	44.094			1.41	1.07			
I-BUTANE	58.120			0.20	0.18			
n-BUTANE	58.120			0.15				
I-PENTANE	72.146							
n-PENTANE	72.146			0.01				
HEXANE PLUS								
TOTAL SULPHUR				24 PPMW	24 PPMW			
TOTAL				99.99	100.00			
AVG. MOL. WT.				17.4	17.07			

LOCATION: (2.1.9)
○ INDOOR ● OUTDOOR ○ GRADE
○ HEATED ● UNDER ROOF ○ MEZZANINE
● UNHEATED ○ PARTIAL SIDES ○
● ELEC. AREA CLASSIFICATION (2.1.15)
○ WINTERIZATION REQ'D. (2.1.9) ● TROPICALIZATION REQ'D. (3.4.6.6)

SITE DATA:
● ELEVATION 197.8 m BAROMETER BAR
○ RANGE OF A 0.3

		DRY BULB	WET BULB
NORMAL	°C	45 / 85%RH	
MAXIMUM	°C	45 / 84%RH	
MINIMUM	°C	0 / 37%RH	
	°C		

UNUSUAL CONDITIONS: ● DUST ○ FUMES
● OTHER (2.1.9)

REMARKS: Noise level, for the compressor package in isolation, shall not exceed 88 dba at 1 meter.

NOISE SPECIFICATIONS: (2.1.10)
○ APPLICABLE TO MACHINE:
SEE SPECIFICATION
○ APPLICABLE TO NEIGHBORHOOD:
SEE SPECIFICATION
ACOUSTIC HOUSING: ○ YES ● NO
SOUND LEVEL See Note dB (A) @ M

APPLICABLE SPECIFICATIONS:
API 617, CENTRIFUGAL COMPR. FOR GEN. REFINERY SERV.
● VENDOR HAVING UNIT RESPONSIBILITY (2.9.1.7)
Rolls-Royce
○ GOVERING SPECIFICATION (IF DIFFERENT)

PAINTING:
● MANUFACTURER'S STD.
○ OTHER

SHIPMENT: (4.4.1)
○ DOMESTIC ○ EXPORT ● EXPORT BOXING REQ'D.
● OUTDOOR STORAGE MORE THAN 6 MONTHS (4.4.1)
SPARE ROTOR ASSEMBLY PACKAGED FOR (4.4.3.10)
○ HORIZONTAL STORAGE ○ VERTICAL STORAGE

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CONSTRUCTION FEATURES

SPEEDS:
MAX. CONT. 5093 RPM TRIP 5350 RPM
MAX. TIP SPEEDS: 194.7 m/s @ 100% SPEED
204.4 m/s @ MAX. CONT. SPEED

LATERAL CRITICAL SPEEDS (DAMPED)

FIRST CRITICAL	2800	RPM	1st Brg	MODE
SECOND CRITICAL	~7100	RPM	2nd Brg	MODE
THIRD CRITICAL	~10600	RPM	1st Bendg	MODE
FOURTH CRITICAL		RPM		MODE

● LATERAL ANALYSIS REQUIRED (2.9.2.3)
● TRAIN TORSIONAL ANALYSIS REQUIRED
(TURBINE DRIVEN TRAIN) (2.9.4.5)

TORSIONAL CRITICAL SPEEDS:

FIRST CRITICAL	Per API 617	RPM
SECOND CRITICAL	Per API 617	RPM
THIRD CRITICAL	Per API 617	RPM
FOURTH CRITICAL	Per API 617	RPM

VIBRATION: Std test limit 39.0 µm, RR to attempt 25 µm with reasonable effort to obtain
ALLOWABLE TEST LEVEL (PEAK TO PEAK)

ROTATION, VIEWED FROM DRIVEN END ○ CW ● CCW

● **MATERIALS INSPECTION REQUIREMENTS (4.2.2)**
● SPECIAL CHARPY TESTING (2.11.3)
● RADIOGRAPHY REQUIRED FOR per specification
● ULTRASONIC REQUIRED FOR plus R-R clarifications
● MAGNETIC PARTICLE REQUIRED FOR Shaft, Impellers
● LIQUID PENETRANT REQUIRED FOR Guide vanes

CASING:
MODEL RFBB36
CASING SPLIT Vertical
MATERIAL CASE & COVER A-34 or A-55 CAST STEEL
THICKNESS (mm) 76 CORR. ALLOW. (mm) 3.2
MAX. WORKING PRESS 150 (BARG)
MAX DESIGN PRESS 155 (BARG)
TEST PRESS (BARG): HELIUM HYDRO 1.5x MWP
MAX OPER. TEMP. 177 °C MIN. OPER. TEMP. -35 °C
MAX NO. OF IMPELLERS FOR CASING 4-5 depends on Appl
MAX CASING CAPACITY (m³/h) 90000
CASING SPLIT SEALING (2.2.10) O-ring
○ SYSTEM RELIEF VALVE SET PT. (2.2.4) (MPaG)(assumed)

DIAPHRAGMS:
MATERIAL Stl ASTM A36; Gray Iron ASTM A48 Cl 40C

IMPELLERS:
NO. 2 DIAMETERS 766.65
NO. VANES EA. IMPELLER 17 (prel)

REMARKS Materials are all RR standard, with years of experience.
Operating Temperature limits are for normal service-Maximum
operating temperature may be modified during detail design
Barrier seal plus separation air system is also included.

TYPE (OPEN, ENCLOSED, ETC.) Enclosed
TYPE FABRICATION Welded
MATERIAL Stl Forging, USS T-1, Type C
MAX. YIELD STRENGTH (N) 620
BRINNEL HARDNESS: MAX 293 MIN 248
SMALLEST TIP INTERNAL WIDTH (mm) After design
MAX. MACH. NO. @ IMPELLER EYE After Design
MAX. IMPELLER HEAD @ 100% SPD (N-m/kg)

SHAFT:
MATERIAL Stl Forging, ASTM A-668 Cl.L
DIA @ IMPELLERS (mm) 215.9 DIA @ COUPLING (mm) 165.1
SHAFT END: ● TAPERED ○ CYLINDRICAL
MAX. YIELD STRENGTH (N) 930
SHAFT HARDNESS (BNH)(Rc) 331 BNH Max
SHAFT HARDNESS (BNH)(Rc) 269 BNH Min

BALANCE PISTON:
MATERIAL Stl Plate ASTM A-514.Gr.F /Q AREA Later (mm²)
FIXATION METHOD Shrink Fit + 2 keys

SHAFT SLEEVES : N / A
AT INTERSTG. CLOSE CLEARENCE POINTS MATL
AT SHAFT SEALS MATL

○ ACCESSILBLE (2.8.2)

LABYRINTHS:
INTERSTAGE
TYPE Renewable MATERIAL Alum AA Alloy 771 T-5
BALANCE PISTON
TYPE Honeycomb MATERIAL SST ASTM A240 Type 321

SHAFT SEALS:
● SEAL TYPE (2.8.3) Tandem Dry Gas Face Seals
○ SETTLING OUT PRESSURE (BARG) TBD
○ SPECIAL OPERATION (2.8.1)
○ SUPPLEMENTAL DEVICE REQUIRED FOR CONTACT SEALS (2.8.3.2) TYPE
● BUFFER GAS SYSTEM REQUIRED (2.8.7) ○ MANIFOLD (3.5.1.6)
● TYPE BUFFER GAS Pri:Filt Process Gas; Sec: N2; Barrier: Air
○ BUFFER GAS CONTROL SYSTEM SCHEMATIC BY VENDOR
○ PRESSURIZING GAS FOR SUBATMOSPHERIC SEALS (2.8.8)
TYPE SEAL Burgmann PDGS intermed laby, intchgble NDE-DE
INNER OIL LEAKAGE GUAR. (λ /DAY/SEAL) N / A
BUFFER GAS REQUIRED FOR:
☐ AIR RUN-IN ■ OTHER N2 for run-in
BUFFER GAS FLOW (PER SEAL):
NORM: 7.1 am³/h @ Design (kPa) Δ P 50
MAX. 10.7 am³/h @ Design (kPa) Δ P 100

BEARING HOUSING CONSTRUCTION:
TYPE (SEPARATE, INTEGRAL) Separate SPLIT Vertical
MATERIAL Stl ASTM A668 Cl B; Iron ASTM A48 Cl 40C

CONSTRUCTION FEATURES (CONTINUED)

BEARINGS AND BEARING HOUSINGS

RADIAL	INLET	EXHAUST
TYPE	Tilt-Pad	Tilt-Pad
MANUFACTURER	Waukesha	
LENGTH (mm)	82.6	82.6
SHAFT DIA. (mm)	165.1	165.1
UNIT LOAD (ACT/ALLOW) (Bar)	<5 / 15	<5 / 15
BASE MATERIAL	Steel	Steel
BABBIT THICKNESS (mm)	Tin Based > 1.5	
NO. PADS	4	4
LOAD: B'TWN/ON PAD	Between	Between
PIVOT: CTR/OFFSET, %	Center	Center

THRUST	ACTIVE	INACTIVE
TYPE	Self Leveling/Tilting Pad	
MANUFACTURER	Waukesha	
UNIT LOADING (MAX BAR)	After Design	After Design
UNIT LOAD (ULT.) (BAR)	44.83	44.83
AREA (mm²)	33226	33226
NO. PADS	9	9
PIVOT: CENTER / OFFSET, %	Offset 70 %	Offset 70%
PAD BASE MATL	Stl / Tin based Babbit	

LUBRICATION: ● FLOODED ○ DIRECTED
THRUST COLLAR: ○ INTEGRAL ● REPLACEABLE
MATERIAL Steel Plate AISI 4340

☐ BEARING SPAN 2263 mm

BEARING TEMPERATURE DEVICES ○ SEE ATTACHED API-670 DATA SHT

- ○ THERMISTORS
  - ○ TYPE ____ POS TEMP COEFF ____ NEG TEMP COEFF
  - ○ TEMP SWITCH & INDICATOR BY: ____ PURCH ____ MFR
- ○ THERMOCOUPLES
  - ○ SELECTOR SWITCH & INDIC. BY: ____ PURCH ____ MFR
- ● RESISTANCE TEMP DETECTORS
  - ● RESISTANCE MAT'L Platinum ● 100 OHMS
  - ○ SELECTOR SWITCH & INDICATOR BY:
    ____ PURCH X MFR
- ● LOCATION-JOURNAL BRG
  NO. ____ EA PAD ____ EVERY OTH PAD 2 PER BRG
  OTHER
- ● LOCATION-THRUST BRG
  NO. ____ EA PAD ____ EVERY OTH PAD 2 PER BRG
  OTHER
  NO. (INACT) EA PAD ____ EVERY OTH PAD 2 PER BRG
  OTHER
- ● MONITOR SUPPLIED BY (3.4.7.4) Rolls-Royce
  - ● LOCATION UCP ENCLOSURE
  - ● MFR. Rolls-Royce ■ MODEL 3500
  - ☐ SCALE RGE ____ ALARM ■ SET @ 120 °C
  - ● SHTDWN ■ SET @ 130 °C ● TIME DELAY 1 SEC

VIBRATION DETECTORS: ○ SEE ATTACHED API-670 DATA SHEET

- ● TYPE Non-Contacting ■ MODEL 3300 XL
- ● MFR Bently-Nevada
- ● NO. AT EA SHAFT BEARING 2 TOTAL NO. 4
- ● OSCILLATOR-DETECTORS SUPPLIED BY Rolls-Royce
  - ● MFR Bently-Nevada ■ MODEL 3300 XL
  - MONITOR SUPPLIED BY (3.4.7.2)
  - ● LOCATION UCP ENCLOSURE
  - ● MFR. Bently-Nevada ■ MODEL 3500
  - ☐ SCALE RGE ____ ALARM ■ SET @ 60 um
- ● SHTDWN: ■ SET @ 90 υμ ○ TIME DELAY 1 SEC

AXIAL POSITION DETECTOR: ○ SEE ATTACH. API-670 DATA SHEET

- ● TYPE Non-Contacting ■ MODEL 3300 XL
- ● MFR Bently-Nevada ● NO. REQUIRED 2
- ● OSCILLATOR-DEMODULATOR SUPPLIED BY Rolls-Royce
  - ● MFR Bently-Nevada ■ MODEL 3300 XL
  - MONITOR SUPPLIED BY (3.4.7.2) Rolls-Royce
  - ● LOCATION UCP ENCLOSURE
  - ● MFR. Bently-Nevada ■ MODEL 3500
  - ☐ SCALE RGE ____ ○ ALARM ■ SET @ + / - .5 μμ
- ● SHTDWN: ■ SET @ +/- .65 μμ ● TIME DELAY 1 SEC

CASING CONNECTIONS

CONNECTION	● DESIGN APPROVAL REQ'D (2.11.2.10)	☐ ASME ☐ API605 ☐ OTHERS SIZE	■ FACING	● POSITION (2.4.2.1)	● FLANGED OR STUDDED (2.4.2.1)	○ MATING FLG & GASKET BY VENDOR (2.4.2.3)	■ GAS VELOCITY m/SEC
INLET	No	914.4mm 900#	RF	Horiz/Side	Flanged	Yes	14.50
DISCHARGE	No	914.4mm 900#	RF	Horiz/Side	Flanged	Yes	11.99

REMARKS

Dimensions indicated (diameters and lengths) are typical for normal service - actual dimensions are subject to design review

Vibration and position detector settings are typical

Axial position alarm and shutdown setting is equal to the measured thrust bearing axial clearance plus the indicated value.

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OTHER CONNECTIONS

SERVICE:	NO.	SIZE	TYPE
LUBE-OIL INLET	2	1"/1"	NPTF/3000#SAE
LUBE OIL OUTLET	4	1"-2"	3000#SAE
SEAL-OIL INLET			
SEAL-OIL OUTLET			
SEAL GAS INLET	2	.75"	3000# SAE
SEAL GAS OUTLET	2	.75"	3000# SAE
CASING DRAINS	2	.75"	3000# SAE
STAGE DRAINS			
VENTS	2	.75"-2"	3000# SAE
VENTS			
PRESSURE	4	1"	NPTF, 2 each nozz
TEMPERATURE	8	1"	NPTF, 4 each nozz
SOLVENT INJECTION			
PURGE FOR:			
BRG. HOUSING			
BTWN BRG & SEAL	2	.75"	3000# SAE
BTWN SEAL & GAS	2	.75"	3000# SAE

○ INDIVIDUAL STAGE DRAINS REQUIRED (2.4.3.2)
○ VALVED & BLINDED
○ VALVED & BLINDED & MANIFOLD 2 Casing drains

KEY PHASOR REQUIRED
● COMPRESSOR ○ GEAR ○ DRIVER

ALLOWABLE PIPING FORCES AND MOMENTS:

	INLET		DISCHARGE			
	FORCE N	MOMT N-m	FORCE N	MOMT N-m	FORCE N	MOMT N-m
AXIAL	Per Rolls-Royce Standard GER 0123 para 3.2, ref Fig 4 & Table 7b					
VERTICAL						
HORIZ. 90						
	FORCE N	MOMT N-m	FORCE N	MOMT N-m	FORCE N	MOMT N-m
AXIAL	Per Rolls-Royce Standard GER 0123 para 3.2, ref Fig 4 & Table 7b					
VERTICAL						
HORIZ. 90						

○ ACCELEROMETER(3.4.7.5) N /A
○ SEE ATTACHED API-670 DATA SHEET
○ TYPE MODEL
○ MFR NO. REQUIRED
○ LOCATION
○ OSCILATOR-DEMODULATORS SUPPLIED BY
○ MFR ☐ MODEL
○ MONITOR SUPPLIED BY (3.4.7.6)
○ LOCATION ENCLOSURE
○ MFR ☐ MODEL
☐ SCALE RANGE ○ ALARM ☐ SET @ mm/SEC²
○ SHTDWN ☐ SET @ mm/SEC² ○ TIME DELAY SEC

ACCESSORIES

COUPLING AND GUARDS (3.2)

NOTE: SEE ROTATING ELEMENTS - SHAFT ENDS
○ SEE ATTACHED API-671 DATA SHEET ● KEYLESS HYDRAULIC ○ KEYED
COUPLING FURNISHED BY Rolls-Royce
MANUFACTURER Bibby or equal TYPE Dry MODEL service factor ≥ 1.75
COUPLING GUARD FURNISHED BY: Rolls-Royce
TYPE: ● FULLY ENCLOSED ○ SEMI-OPEN ○ OTHER non-sparking

COUPLING DETAILS (PREL)

■ MAX O.D. 427 mm
■ HUB WEIGHT 46 kg
■ SPACER LENGTH 1524 (1524 DBSE) mm
■ SPACER WEIGHT 163 kg

● VENDOR MOUNT HALF COUPLING
LUBRICATION REQUIREMENTS:
● NON-LUBE ○ GREASE ○ CONT. OIL LUBE ○ OTHER
QUANTITY PER HUB kgs or L/MIN

MOUNTING PLATES

○ BASEPLATES: FURNISHED BY (3.3.1.1)
○ COMPRESSOR ONLY (3.3.2.1) ○ DRIVER ○ GEAR
○ OTHER
○ DRIP TRIM ○ LEVELING PADS (3.3.2.2)
○ COLUMN MOUNTING (3.3.2.3)
○ SUB-SOLE PLATES REQ'D (3.3.3.2)
☐ STAINLESS STEEL SHIM THICKNESS mm
PRIMER FOR EPOXY GROUT REQ'D (3.3.1.2.9)
TYPE

○ BASE PLATE WILL BE ON CONCRETE FOUNDATION (3.3.2.5)
○ MACHINED MOUNTING PADS REQ'D. (3.3.2.6)

● SOLEPLATES: FURNISHED BY: Rolls-Royce
☐ THICKNESS mm
● SUBSOLE PLATES REQ'D (3.3.3.2)
■ STAINLESS STEEL SHIM THICKNESS - mm
○ DRIVER ○ GEAR ● COMPRESSOR 3.2 mm
● PRIMER FOR EPOXY GROUT REQ'D (3.3.1.2.9)
TYPE

REMARKS
Number and size of connections is preliminary
Final quantity and location will be advised after final design
is complete.
Foundation bolts by Rolls-Royce

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UTILITIES

UTILITY CONDITIONS: (see R-R proposal)

STEAM: N /A	DRIVERS		HEATING	
INLET MIN	BARG(kPaG)	°C	BARG(kPaG)	°C
NORM	BARG(kPaG)	°C	BARG(kPaG)	°C
MAX	BARG(kPaG)	°C	BARG(kPaG)	°C
EXHAUST. MIN	BARG(kPaG)	°C	BARG(kPaG)	°C
NORM	BARG(kPaG)	°C	BARG(kPaG)	°C
MAX	BARG(kPaG)	°C	BARG(kPaG)	°C

ELECTRICITY: (3.4.6.1)

	DRIVERS	HEATING	CONTROL	SHUTDOWN
VOLTAGE				
HERTZ				
PHASE				

COOLING WATER: N /A
TEMP. INLET °C MAX RETURN °C
PRESS NORM BARG(kPaG)
DESIGN BARG(kPaG)
MIN RETURN BARG(kPaG)
MAX ALLOW Δ P BAR(kPa)
WATER SOURCE
INSTRUMENT AIR:
MAX PRESS BARG(kPaG) MIN PRESS BARG(kPaG)

TOTAL UTILITY CONSUMPTION:

COOLING WATER	N /A	m³/h
STEAM, NORMAL	N /A	kg/h
STEAM, MAX	N /A	kg/h
INSTRUMENT AIR	Separation seal air - 20	m³/h
HP (DRIVER)	See compressor preformance	kW
HP (AUXILIARIES)	See P&ID's	kW
HEATERS	See P&ID's	KW
PURGE (AIR OR N_2)	Only required for initial start-up	m³/h

MISCELLANEOUS: per RR standards

- RECOMMENDED STRAIGHT RUN OF PIPE DIAMETERS BEFORE SUCTION: Minimum of 3
- ○ NOMOGRAPHS REQUIRED FOR EACH SECTION (5.3.3.1.5)
- ● VENDOR'S REVIEW & COMMENTS ON PURCHASER'S PIPING & FOUNDATION (3.5.3.2) Scope/Responsibility to be agreed pre-order
- ○ COMPRESSOR TO BE SUITABLE FOR FIELD RUN IN ON AIR (2.1.17)
- ○ PROVISION FOR LIQUID INJECTION (2.1.11)
- ● VENDOR'S REVIEW & COMMENTS ON PURCHASER'S CONTROL SYSTEMS (3.4.1.1)
- ○ EXTENT OF PROCESS PIPING BY VENDOR (3.5.3.1)
- ○ SHOP FITUP OF VENDOR PROCESS PIPING (4.4.3.11)
- ● WELDING HARDNESS TESTING (4.2.1.6)
- ○

VENDOR'S REPRESENTATIVE SHALL (2.1.14)

- ○ OBSERVE FLANGE PARTING
- ○ CHECK ALIGNMENT AT TEMPERATURE
- ○ BE PRESENT AT INITIAL ALIGNMENT

SHOP INSPECTION AND TESTS: (4.1.4)	REQ'D.	WITN
CLEANLINES (4.2.1.5)	●	
HYDROSTATIC	●	
IMPELLER OVERSPEED	●	●
MECHANICAL RUN	●	●
● CONTRACT COUPLING ○ IDLING ADAPTORS		
● CONTRACT PROBES ○ SHOP PROBES		
VARY LUBE & SEAL OIL PRESSURES AND TEMPERATURES (4.3.4.2.5) within allowable limits	●	●
POLAR FORM VIB DATA (4.3.4.3.3) Bode plot in polar form	●	
VIBRATION DATA RECORDED (4.3.4.3.6) Adre digital data	●	
DATA TO PURCHASER (4.3.4.3.7) Adre data via CD	●	
SHAFT END SEAL INSP (4.3.4.4.1)	●	●
GAS LEAK TEST DISCH PRESS (4.3.5.2)	●	●
○ BEFORE ● AFTER POST TEST INSPECTION (4.3.6.8)		
PERFORMANCE TEST(GAS)(PTC10 TYPE II)(4.3.6.1)	●	●
NO LOAD STRING TEST (4.3.6.2) (ONE PER STATION)	●	●
DIS-ASSEMBLE/RE-ASSEMBLE AFTER TEST (REM-7)	●	●
DYNAMIC BALANCING OF ROTOR W/O HALF COUPLING	●	Obs
GEAR TEST (4.3.6.4)	○	
HELIUM LEAK TEST	○	
SOUND LEVEL SURVEY DURING STRING TEST	●	●
SHOP VERIFICATION OF UNBALANCED RESPONSE	●	●
ANALYSIS (@ COUPLING HUB ONLY) (ONE PER STATION)		
COPIES OF CERTIFIED TEST DATA & MATERIALS	●	
RESIDUAL ELECT. & MECH RUN OUT	●	●
CHECK BEARINGS & SEALS AFTER TEST (REM-7)	●	●
	●	●

WEIGHTS (kg):

COMPR.	46500	GEAR		DRIVER	BASE
ROTORS: COMPR.	1125	DRIVER		GEAR	
COMPRESSOR COVER	5500				
SOUR SEAL OIL TRAPS	N/A				
L.O. CONSOLE		S.O. CONSOLE			
OVERHEAD SEAL OIL TANKS	N/A				
MAX. FOR MAINTENANCE (IDENTIFY)	Aero and Rotor 10100				
TOTAL SHIPPING WEIGHT	Compressor + Pipe and Elect 49500				

SPACE REQUIREMENTS (mm): (See R-R Proposal)

COMPLETE UNIT:	L		W		H	
L.O. CONSOLE:	L		W		H	
S.O. CONSOLE:	L		W		H	
SOUR SEAL OIL TRAPS						
OVERHEAD SEAL OIL TANKS						

SEE INSTALLATION SECTION OF PROPOSAL

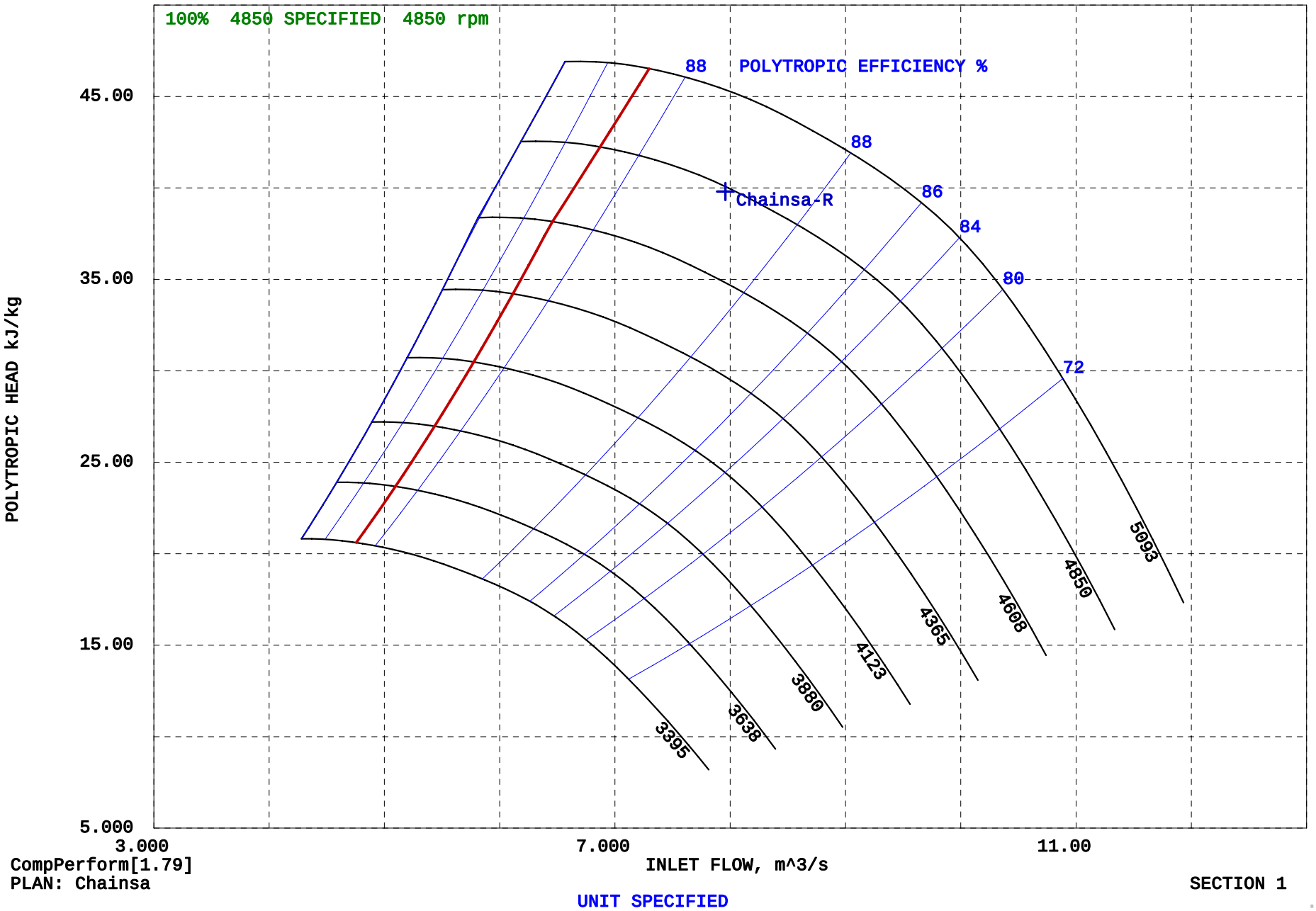
REMARKS:
5) Spare rotor will receive mech run test
6) No load string test shall be carried out for one GTC package per station
7) Post test inspection of the dry gas seal and bearing shall be carried during the spare rotor changeout only. DGS inspection as per Burgmann instructions

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.393 Pd 99.930 kG/cm^2.g Ti 34.50 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

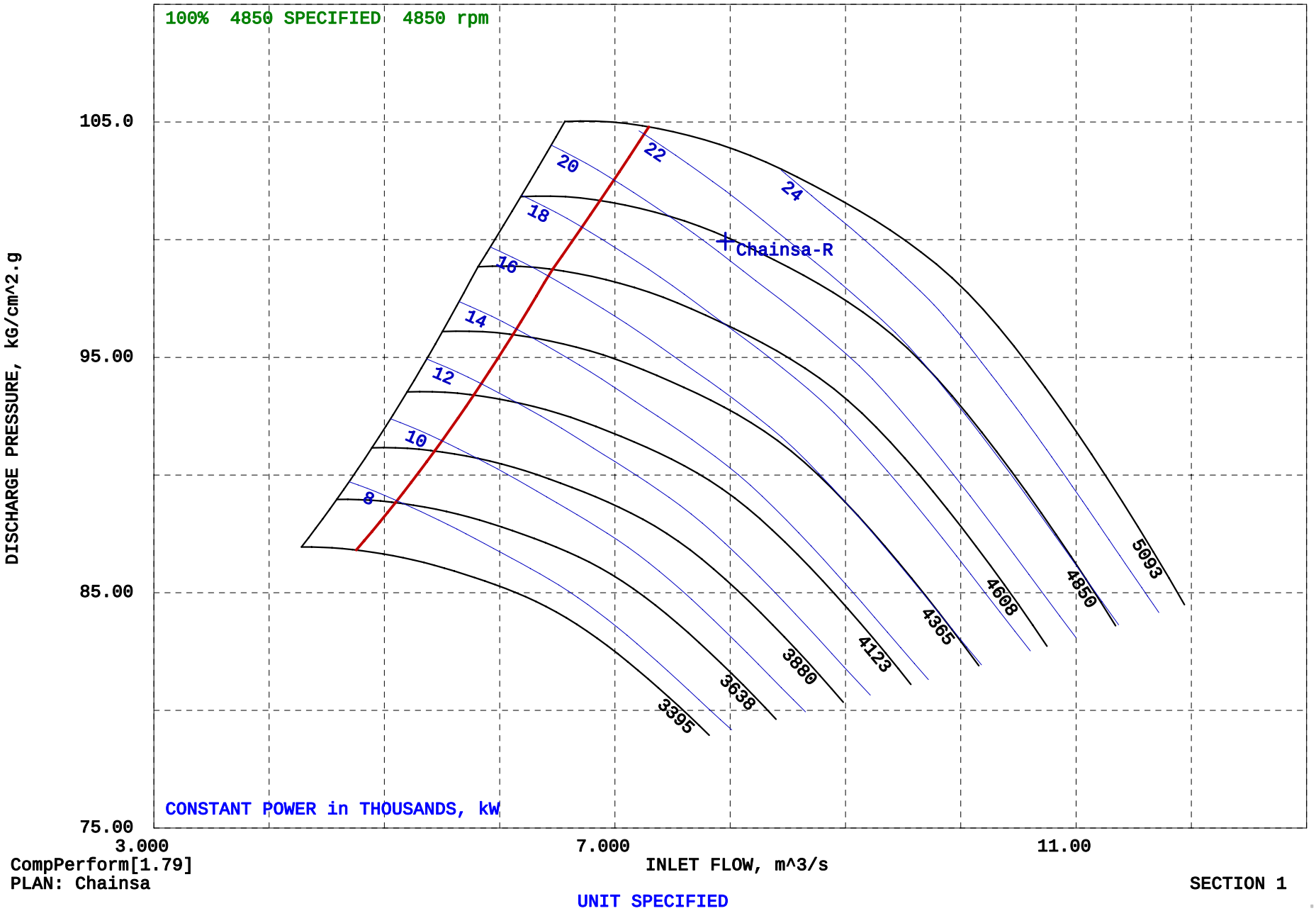
UNIT SPECIFIED

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.393 Pi 74.100 kG/cm^2.g Ti 34.50 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

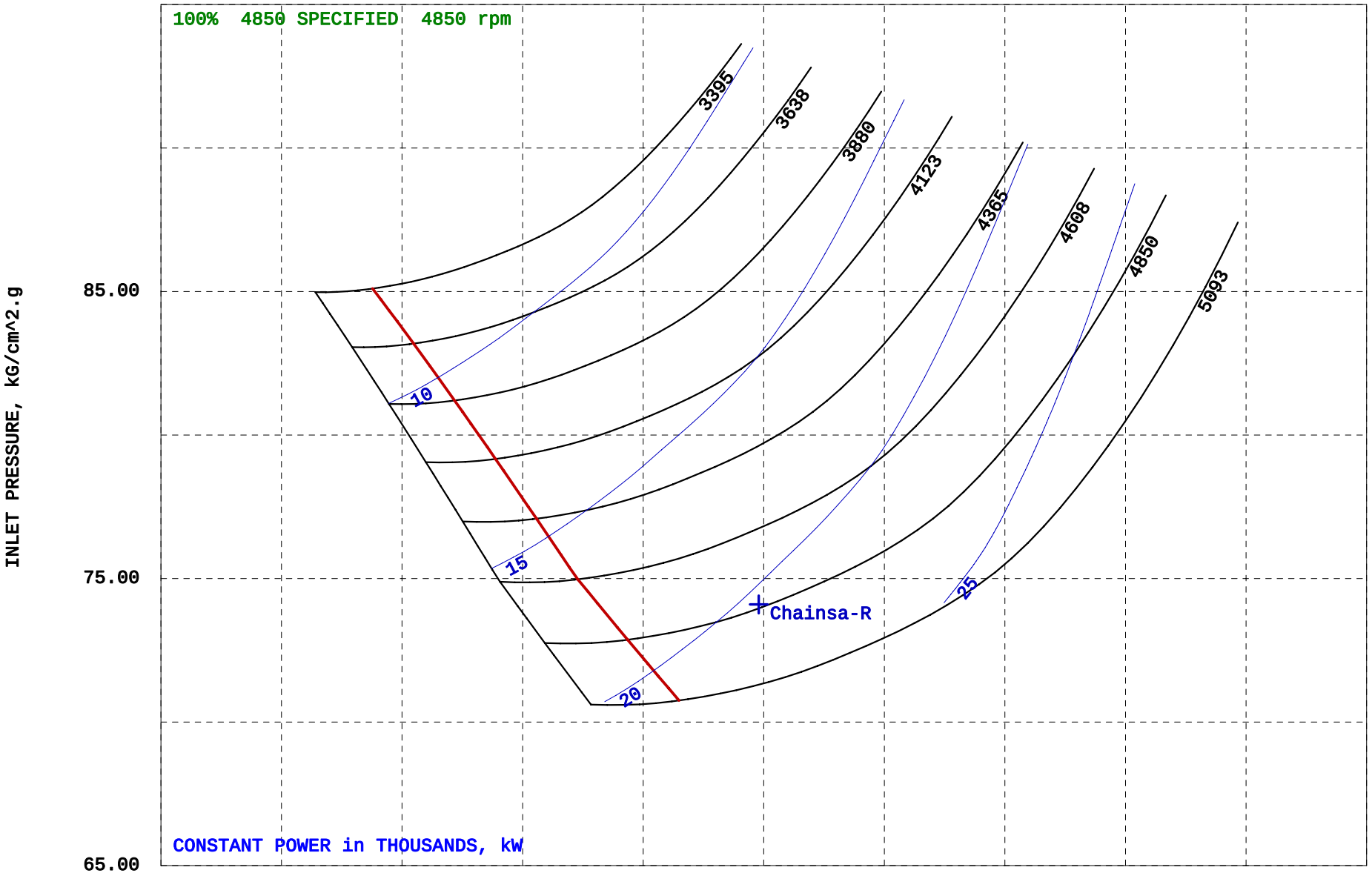
UNIT SPECIFIED

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.393 Pd 99.930 kG/cm^2.g Ti 34.50 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

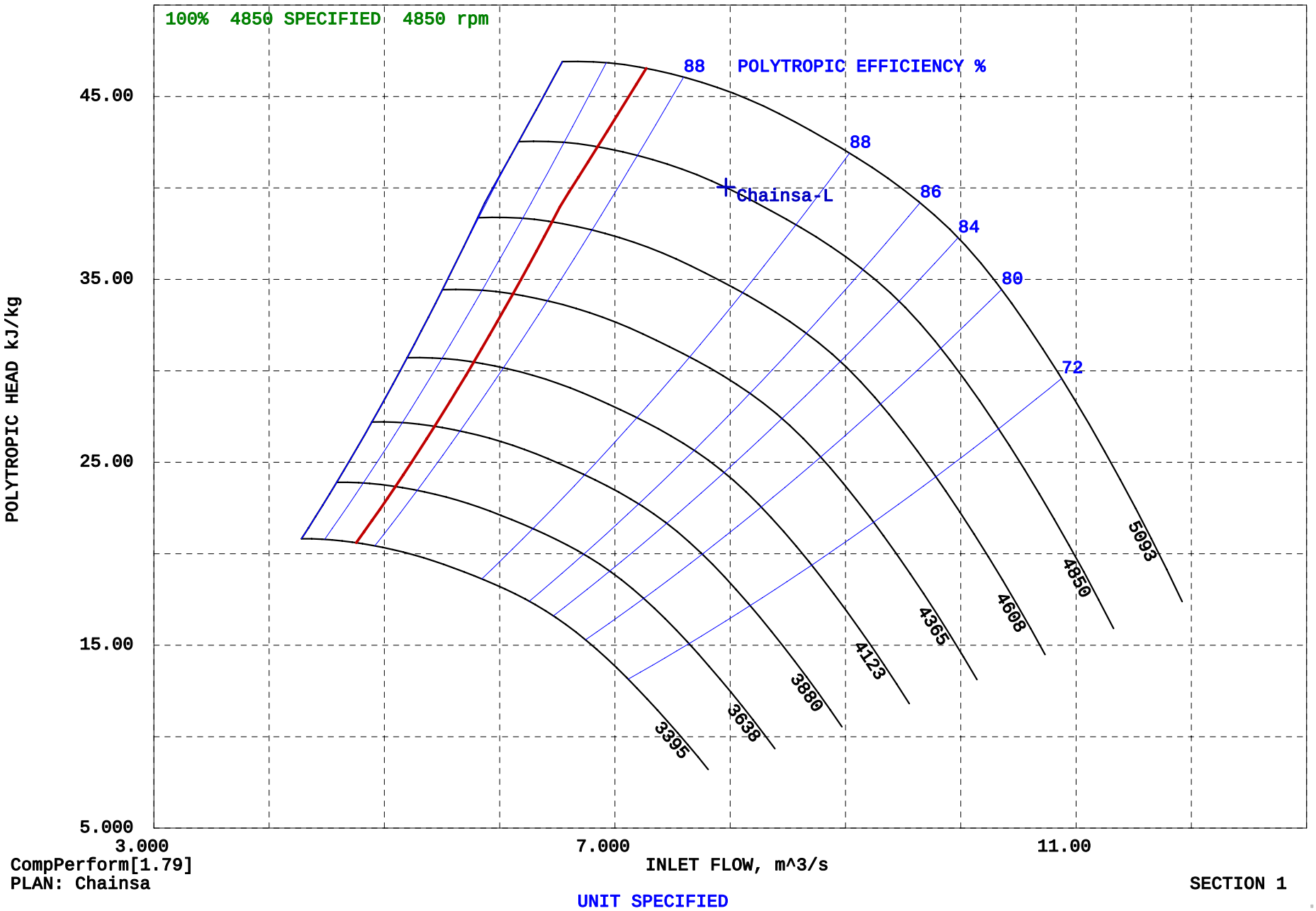
UNIT SPECIFIED

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.074 Pd 99.930 kG/cm^2.g Ti 34.40 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

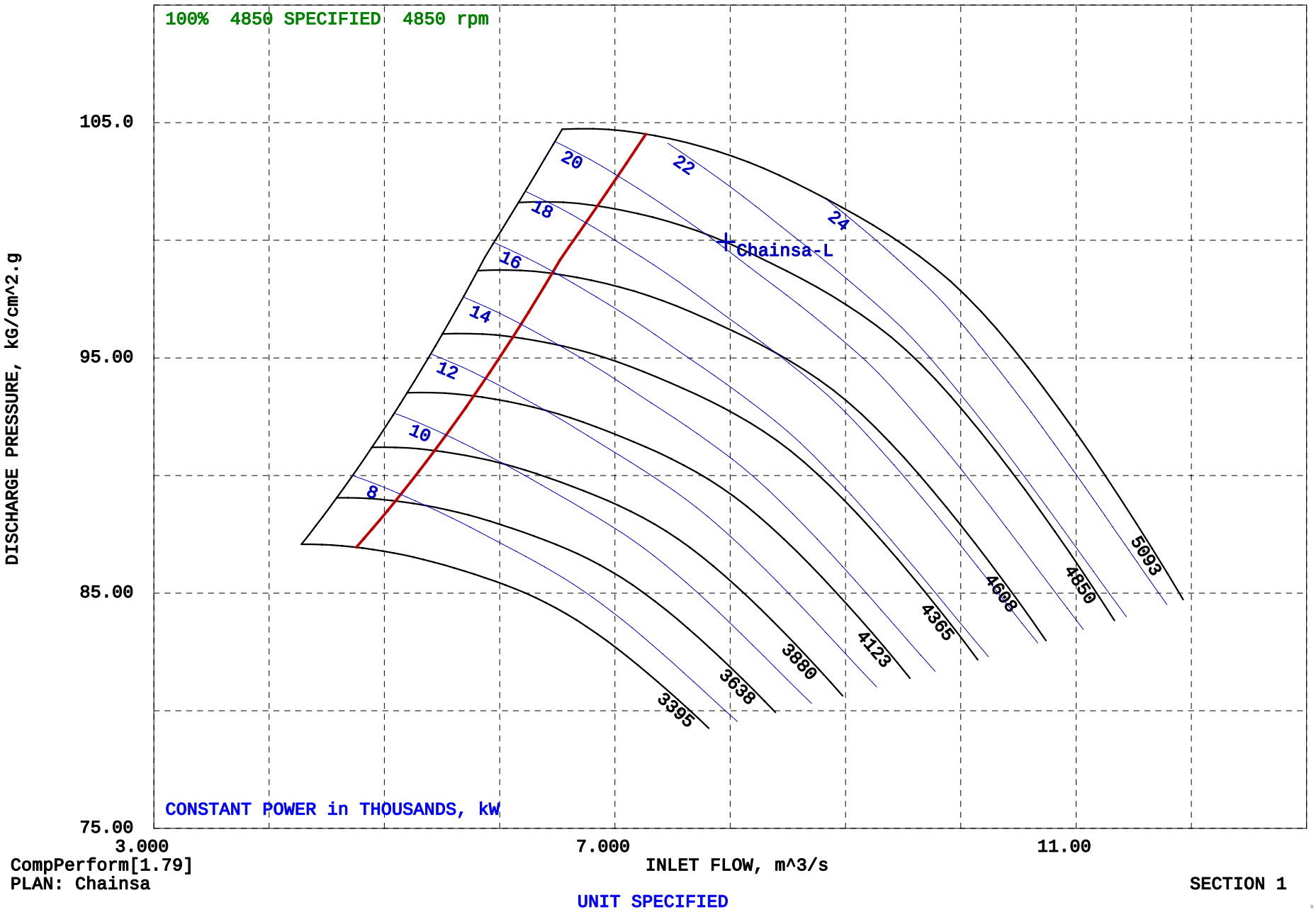
UNIT SPECIFIED

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.074 Pi 74.500 kG/cm^2.g Ti 34.40 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

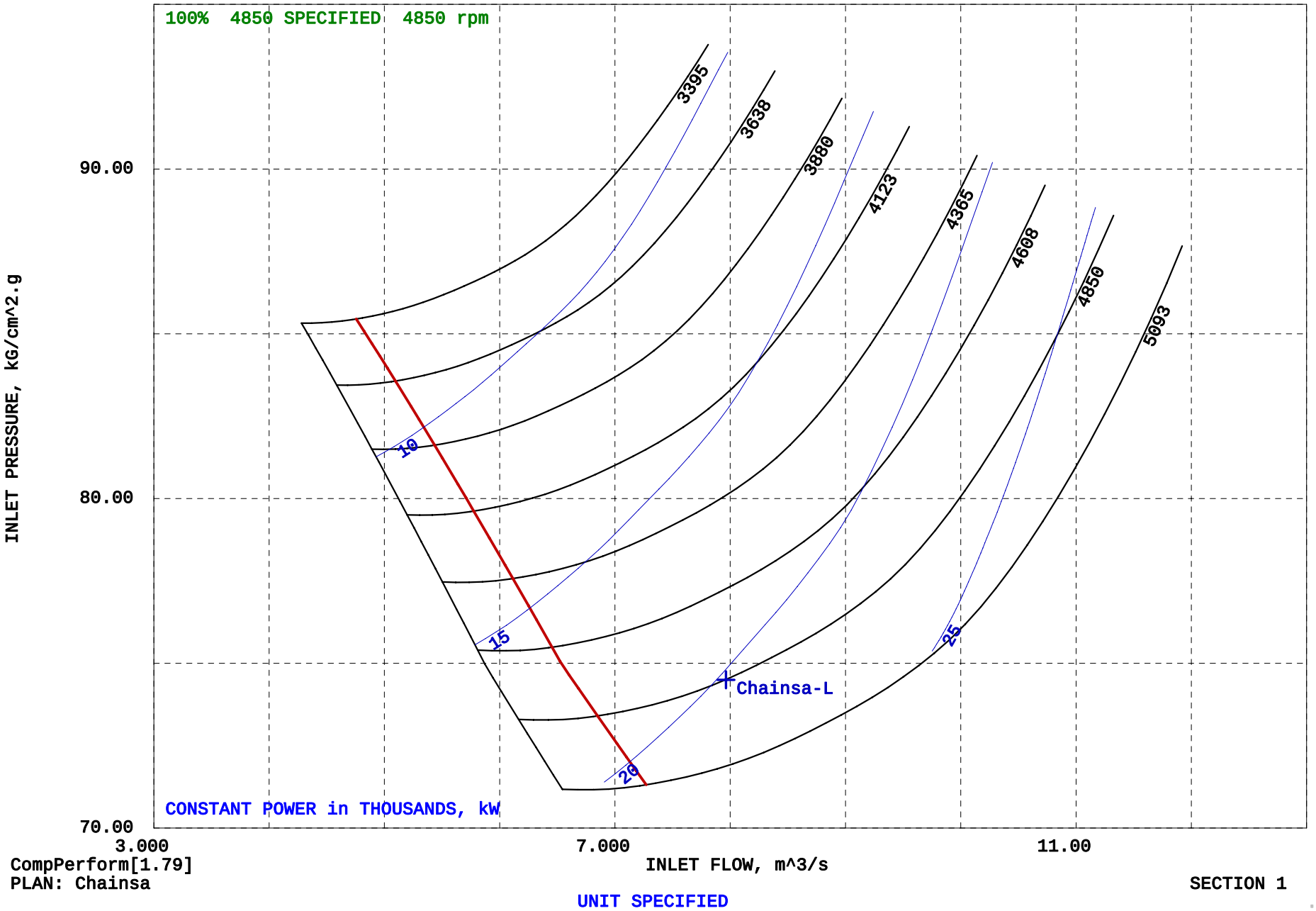
UNIT SPECIFIED

Rolls-Royce Energy Systems Inc.

Tue Mar 31 09:57:34 2009

GAIL Pipeline Expansion Project Feb 24'09

RF36-2 MW 17.074 Pd 99.930 kG/cm^2.g Ti 34.40 °C



CompPerform[1.79]

PLAN: Chainsa

SECTION 1

UNIT SPECIFIED

ENGINEERS INDIA LIMITED
NEW DELHI

JOB NO. 6988 ITEM NO.
PURCHASE ORDER NO.
SPECIFICATION NO 6988-000-KA-MR-5010
REVISION NO. 0 DATE 5-Apr-09
PAGE 1 OF 10 BY Leong, HT

REV

COMBUSTION GAS TURBINE (API 616-4TH) DATA SHEET SI UNITS

APPLICABLE TO: ● PROPOSAL ○ PURCHASE ○ AS BUILT
FOR **GAIL (INDIA) LIMITED** UNIT **PIPELINE EXPANSION PROJECT**
SITE **CHAINSA STATION** SERIAL NO.
SERVICE **GAS COMPRESSOR** NO. REQUIRED **TWO (2)**
● CONTINUOUS ○ INTERMITTENT ○ STANDBY DRIVEN EQUIP. **CENTRIFUGAL COMPRESSOR**
MANUFACTURER **Rolls-Royce** ● MODEL **RB211-GT61 DLE** ISO RATING **32,987** kW @ **4850** RPM
NOTE: INFORMATION TO BE COMPLETED: ○ BY PURCHASER ☐ BY MANUFACTURER ◯ BY MFR IF NOT BY PURCHASER

GENERAL

CYCLE: ○ REGEN ● SIMPLE ○ EXHAUST HEAT RECOVERY TYPE: ◯ SINGLE SHAFT ● MULTI SHAFT
DRIVEN EQUIPMENT: NORMAL SHAFT , kW @ RPM RATED SHAFT (KW) @ RPM
OUTPUT SHAFT SPEED RANGE (4.1.5) ● MIN **3152** ■ MAX **5090** RPM
DESIRED MINIMUM SITE POWER kW @ RPM ● ENCLOSURE REQUIRED
OPERATION ● ATTENDED ○ UNATTENDED ☐ POTENTIAL MAXIMUM POWER (3.33) Kw

PERFORMANCE

GAS TURBINE INCLUDING ALL LOSSES

	SITE RATED (3.45)	NORMAL DUTY (3.26)	SITE MAX TEMP	SITE MIN TEMP
● DRY BULB TEMP, °C	45		45	0
● RELATIVE HUMIDITY %	84		84	37
● ALTITUDE (m)	197.8		197.8	197.8
☐ OUTPUT, (KW) (1)				
☐ HEAT RATE, LHV, MJ/ KW-HR	FOR GAS TURBINE SITE PERFORMANCE PLEASE REFER TO PERFORMANCE DATASHEET UNDER THIS SECTION OF THE PROPOSAL.			
◯ OUTPUT SHAFT SPEED, RPM				
☐ AIR FLOW kg/SEC				
☐ EXHAUST FLOW kg/SEC (1)				
☐ FIRING TEMPERATURE °C				
☐ GAS GEN. EXHAUST TEMP °C				
☐ PT EXHAUST TEMP. °C				
● CERTIFIED POINT (3.26)	YES			

(1) INCLUDING ○ STEAM ○ WATER EFFECTS FOR
◯ EMISSION CONTROL ◯ AUGMENTATION (4.1.9)
☐ STEAM FLOW, kg/HR
☐ WATER FLOW, m³/HR

APPLICABLE SPECIFICATIONS:
● API 616 GAS TURBINES FOR THE PETROLEUM,CHEMICAL, & GAS INDUSTRY SERVICES
○ GOVERNING SPECIFICATION (IF DIFFERENT)
● VENDOR HAVING UNIT RESPONSIBILITY (4.1.2)
Rolls-Royce

SHIPMENT: (6.4)
○ DOMESTIC ● EXPORT ○ EXPORT BOXING REQD.
○ OUTDOOR STORAGE MORE THAN 6 MONTHS (6.4.1)
SPARE ROTOR ASSEMBLY PACKAGED FOR (6.4.3.10)
○ DOMESTIC ○ EXPORT SHIPMENT
COMMENTS:

LOCATION (4.1.19)

○ INDOOR ● OUTDOOR ○ GRADE
○ HEATED ● UNDER ROOF ○ MEZZANINE
● UNHEATED ○ PARTIAL SIDES ● ONSHORE
ELEC. AREA CLASSIFICATION (4.1.14)
○ NON-HAZARDOUS ● HAZARDOUS
APPLICABLE CODE: ○ NEC500 ○ NEC505 ● IEC
GROUP **IIA** CLASS: TEMPERATURE CODE: **T3**
AREA CLASSIFICATION ○ DIVISION ● ZONE **2**
○ THIRD PARTY CERTIFICATION REQUIRED
○ WINTERIZATION REQD ○
● TROPICALIZATION REQD (5.4.6.6)
UNUSUAL CONDITIONS: ● DUST ○ FUMES
● CORROSIVE AGENTS (4.10.1.1)
● SO2 ANNUAL MEAN - 6.01mg/m3, 24hr max - 10.66mg/m3
● OTHER (5.5.3.4) **ONSHORE OIL&GAS**

NOISE SPECIFICATIONS: (4.1.10)
● APPLICABLE TO MACHINE: (5.7.4.1)
SEE SPECIFICATION 88 dBA at 1 meter
○ APPLICABLE TO NEIGHBORHOOD: (5.7.4.2)
SEE SPECIFICATION

PAINTING:
● MANUFACTURER'S OFFSHORE STD.
○ OTHER

NOTE: All Data Sheets References to GG=Gas Generator
SS = Single Shaft and PT = Power Turbine
REMARKS:
Also see Rolls-Royce Deviations to API 616

ENGINEERS INDIA LIMITED
NEW DELHI

COMBUSTION GAS TURBINE (API 616-4TH)
DATA SHEET
SI UNITS

SPEC NO. 6988-000-KA-MR-501(ITEM NO.
REVISION NO. 0 DATE 5-Apr-09
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REV

FUEL SYSTEM (5.8)

TYPE ● GAS (5.8.2) ○ LIQUID (5.8.3) ○ DUAL (5.8.1.5.1)
DUAL SYSTEM REQMTS (5.8.1.5.1) ○ GAS/GAS ○ GAS/LIQUID ○ LIQUID/LIQUID
○ COMPLETE FUEL RECEIVING SYSTEM (5.8.1.1) ○ MAX. TIME ALLOWED TO COMPLETE TRANSFER _____ SECONDS

GAS FUELS (5.8.2)

● FUEL ANALYSIS - MOL % (3.7.2.1) (3.7.1.8)

COMPOSITION:	M.W.	NORMAL	STARTING	ALT
AIR	29	THE FUEL GAS COMPOSITION		
OXYGEN	32	IS AS INDICATED IN THE COMPRESSOR		
NITROGEN	38	PROCESS DATA SHEET		
WATER VAPOR	18	INCLUDED IN THIS SECTION.		
HYDROGEN SULPHIDE	34			
CARBON DIOXIDE	44			
HYDROGEN	2			
METHANE	16			
ETHYLENE	26			
ETHANE	30			
PROPYLENE	42			
PROPANE	44			
I-BUTANE	58			
N-BUTANE	58			
I-PENTANE	72			
N-PENTANE	72			
HEXANE	86			
HEPTANE	100			
TOTAL				
AVG. MOL. WT.				
CORS AGENTS (5.8.2.3)	PPM			
CONTMNTS)5.8.2.2.1)	PPM			
LHV MJ/m³/HR (5.8.2.4)				
FUEL PRESS.MAX/MIN,kPag				
FUEL TEMP MAX/MIN °C		/	/	/
☐ FUEL PRESS/TEMP REQD. MIN BarA/DegC				

COMPRESSION SYS REQD (5.8.1.2.2) ○ YES ○ NO
HEATER REQD (5.8.2.1) ☐ YES ☐ NO
○ RATE OF CHANGE OF LHV (5.8.2.4) _____

REMARKS: _____

LIQUID FUELS (5.8.3)

FUEL GRADE (5.8.3.3)

ASTM D1655 ASTM ○ 0GT ○ 1GT
JET ○ A ○ A-1 ○ B D2880 ○ 2GT ○ 3GT ○ 4GT
○ OTHER, INDICATE ANALYSIS BELOW (5.8.3.3 c)
LIQUID FUEL TREATMENT REQUIRED ◎ YES ◎ NO
TREATMENT SYSTEM BY (3.7.1.5) ○ VENDOR ○ OTHER _____
FUEL TRANSFER EQUP REQUIRED (5.8.1.4.5) ☐ YES ☐ NO
HEATER REQUIRED (5.8.1.4.4) ☐ YES ☐ NO
☐ LIQ FUEL PRESS REQD, MAX/MIN,(kPaG) _____ / _____

FUEL ANALYSIS DATA (5.8.3.3) PROPERTY	ASTM METHOD	MEASURED VALUE
VISCOSITY SSU, 38°C	D-445	
DISTILLATION DATA	D-86	
50% RECOVERY °C MAX		
END POINT °C MAX		
SULFUR CONTENT %WT. MAX. (SELECT APPL. METHOD)		
BOMB METHOD	D-129	
LAMP METHOD	D-1266	
HIGH-TEMP METHOD	D-1552	
CARBON RESIDUE (ON 10%		
BOTTOMS)	% WT. MAX.	
CONRADSON	D-189	
RAMSBOTTOM	D-524	
COPPER STRIP CORROSION PLATE	D-130	
3 HRS AT 100°C MAX		
AROMATIC CONTENT	D-1319	
ASH CONTENT	D-482	
SPECIFIC GRAVITY, 15°C	D-1298	
FLASH POINT °C	D-56	
POUR POINT °C	D-97	
WATER	D-95	
FILTERABLE DIRT. MG/100ML	D-2276	
TRACE METALS (ATOMIC ABSORPTION PREFERRED)	D-3605	
SODIUM		
POTASSIUM		
VANADIUM		
CALCIUM		
LEAD		
OTHER METALS _____		
LOWER HEATING VALUE MJ/kg	D-2382	

FUEL SYSTEM PIPING

○ BY PASS AND VENT VALVE (3.7.1.3) ■ ISOLATION BLOCK VALVES ◎ ANSI FLANGE RATING
○ TWIN Y-TYPE STRAINER WITH CONTINUOUS FLOW ■ NACE 2002 MATERIAL STANDARDS (4.10.1.8)
○ TRANSFER VALVE (5.8.1.2.4)

ENGINEERS INDIA LIMITED
NEW DELHI

COMBUSTION GAS TURBINE (API 616-4TH) DATA SHEET SI UNITS

SPEC NO. 6988-000-KA-MR-501(ITEM NO.
REVISION NO. 0 DATE 5-Apr-09
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R E V

CONSTRUCTION FEATURES (NOTE 1)

■ SPEEDS: **(POWER TURBINE)**
MAX. CONT. **5090** RPM TRIP **5335** RPM
☐ LATERAL CRITICAL SPEEDS (DAMPED)
FIRST CRITICAL ____ RPM ____ MODE
SECOND CRITICAL ____ RPM ____ MODE
THIRD CRITICAL ____ RPM ____ MODE
FOURTH CRITICAL ____ RPM ____ MODE
☐ PROTOTYPE OR MODIFIED ROTOR SUPPORT (4.7.3.5)
● LATERAL ANALYSIS REQUIRED (INDIVIDUAL COMPONENTS) (D.1.3)
● TRAIN TORSIONAL ANALYSIS REQUIRED (2.7.4.5)
■ TORSIONAL CRITICAL SPEEDS:
FIRST CRITICAL **Per API 616** RPM
SECOND CRITICAL **Per API 616** RPM
THIRD CRITICAL ____ RPM
FOURTH CRITICAL ____ RPM
VIBRATION: (4.7.4.5) (7.2.3 o):
■ ALLOWABLE TEST LEVEL : SHAFT **PT: 50** MICRONS P/P
CASE **GG: 16** mm/sec
■ ROTATION, VIEWED FROM DRIVE END ■ CW ○ CCW

AIR COMPRESSOR:
STAGES **7IP,6HP** MAX. TIP SPEED **5.85** m/SEC
TYPE **Axial** PRESSURE RATIO **21:1**
CASING SPLIT (2.2.3) ● AXIAL ○ RADIAL
ROTOR ☐ SOLID ■ BUILT UP

TURBINE:
STAGES **1HP,1LP,3PT** MAX. TIP SPEED **8.65(GG),7.3(PT)** m/SEC
CASING SPLIT (4.2.3) ■ AXIAL **(GG)** ● RADIAL **(PT)**
ROTOR ☐ SOLID ■ BUILT UP

COMBUSTORS: (4.3.2)
☐ SINGLE ■ MULTIPLE, NUMBER 9
■ GAS ☐ LIQUID ☐ DUAL FUEL
MAX. ALLOW TEMP. VARIATION **+/-150** °C
APPLICABLE PLANE ____
FUEL NOZZLES PER COMBUSTOR **3**
○ WOBBE INDEX NO REQD (4.3.7) ☐ MAX ____ MIN ____

MAINTENANCE INTERVALS, HOURS
■ HOT GAS PATH INSPECTIONS **See Note 2**
■ MAJOR OVERHAULS **See Note 3**
■ OTHER ____ **See Note 4**

GOVERNOR (5.4.3)

● MFR'S STD. ○ OTHER ○ MAKE ____ MODEL ____
○ CONSTANT SPEED ● VARIABLE SPEED
○ ISOCHRONOUS ○ DROOP
REMOTE SHUTDOWN SIGNAL ● ELECTRIC
○ PNEUMATIC ○ HYDRAULIC ○ NONE
MANUAL SPEED CHANGER RPM **5090** MAX. **4610** MIN.
○ MAINTAIN TURBINE SPEED UPON FAILURE OF CONTROL SIGNAL OR ACTUATOR

MATERIALS OF CONSTRUCTION (4.10)

COMPRESSOR ROTOR BLADES **Titanium Alloy,FV.535,Inco 738 & 718, Nimonic 105**
COMPRESSOR STATOR VANES **Jethete 152 & EAX,Inco718,Nimonic 105**
SHAFT **Steel** BLADE/VANE COATING **Sermetal 5375 & Waspaloy**

TURBINE STAGE		NOZZLES	BLADES	WHEELS OR DISCS
1	(GG)	Mar-M-002	CMSX-4	Waspalloy
2	(GG)	C.1023	CMSX-4	Incoloy 901
3				
1	(PT)	Rene'80	Rene'80	901
2	(PT)	U-500	U-500	901
3	(PT)	N-155	U-500	901

COMBUSTORS **C.263 and Nimonic 75**
COMPRESSOR CASING **Aluminum Alloy,Jethete EAX, Inco 907/904**
COMBUSTOR CASING **Jethete 152**
TURBINE CASING **GG: Nimonic P.E. 16,PT: Waspaloy, Inconel 718**

GAUGE BOARDS AND CONTROL PANELS

GAUGE BOARDS
☐ LOCATION ____
CONTROL PANELS (5.4.5.1.1) ○ ON-SKID ○ OFF SKID LOCAL ● OFF SKID REMOTE
WEATHER PROTECTION REQUIRED ○ YES ○ NO
○ SPECIFICATION ____
○ ANNUNCIATOR REQUIRED (5.4.4.8.5)
■ VISUAL DISPLAY UNIT (VDU) ■ KEYBOARD

CONTROL SYSTEMS

TYPE (5.4.1.5)
○ MECH ○ PNEU ○ HYDRA ○ ELECTRIC ● ELECTRONIC
● MICROPROCESSOR BASED ○ COMBINED ____
● SIGNAL SOURCE 4-20 mA, 24 V dc
○ SENSITIVITY ____ ○ RANGE ____ TO ____
○ TIME OF AC OUTAGE RIDEOUT ____ MIN (5.4.1.6)
○ SHUT OFF VALVES FOR SHUT DOWN SENSORS (5.4.4.9)
STARTING SYSTEM (5.4.2.1)
○ MANUAL ○ SEMI AUTOMATIC ● AUTOMATIC
☐ PURGE (5.4.2.2) ____ MINUTES
○ SEPARATE SHUTDOWN VALVE TEST DURING OPERATION

NOTE (1) FOR MULTIPLE SHAFT TURBINES, COMPLETE ALL APPLICABLE PORTIONS FOR EACH SHAFT

REMARKS: (2) Half Life refurbishment required generally after 25,000 hours of operation; (3) Major overhaul of GG on condition (generally 50,000 hrs. operation); (4) Borescope Inspection recommended generally after 4,000 hrs operation

ENGINEERS INDIA LIMITED
NEW DELHI

SPEC NO. 6988-000-KA-MR-501(ITEM NO.
REVISION NO. 0 DATE 5-Apr-09
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R E V

COMBUSTION GAS TURBINE (API 616-4TH) DATA SHEET SI UNITS

CONSTRUCTION FEATURES CONTINUED (NOTE 1)

RB211 GAS GENERATOR

BEARINGS AND BEARING HOUSINGS (4.8)

RADIAL (ROLLER, SQUEEZE-FILM TYPE)	HP & IP Turbine	IP Compressor
TYPE	Anti-Friction	Anti-Friction
MANUFACTURER	RHP/FAG (TYP)	RHP (TYP)
BEARING WIDTH, mm	39.6	24.3
OUTER/INNER DIAMETER, mm	254.4 / 221.6	285.5 / 252.1
UNIT LOAD (ACT/ALLOW) kPa	/	/
OUTER RACE MATERIAL	AMS6491	AMS6491
ROLLER MATERIAL	AMS6491	AMS6491
CAGE MATERIAL	AMS6415	AMS6415
LOAD: BETWEEN/ON PAD		
PIVOT: CENTER/OFFSET, %		
DAMPER BEARING		
L10 LIFE (On Condition), h	>50,000	>50,000

THRUST (LOCATION TYPE)	IP Compressor	HP Compressor
TYPE	Anti-Friction	Anti-Friction
MANUFACTURER	RHP/FAG (TYP)	RHP (TYP)
BEARING WIDTH, mm	63.4	76.2
OUTER/INNER DIAMETER, mm	215.9 / 139.7	215.8 / 127.0
UNIT LOAD (MAX POTEN.), kPa		
OUTER RACE MATERIAL	MSRR6113	MSRR6083
ROLLER MATERIAL	MSRR6113	MSRR6083
CAGE MATERIAL	MSRR6083	MSRR6013
L10 LIFE (On Condition), h	>50,000	>50,000

LUBRICATION: ◯ FLOODED ■ SCAVENGE SYSTEM
THRUST COLLAR: ◯ INTEGRAL ◯ REPLACEABLE
BEARING MATERIAL

BEARING TEMPERATURE DEVICES (4.8.5.5) ○ SEE ATTACHED API-670 DATA SHEET

○ THERMOCOUPLES
○ SELECTOR SWITCH & IND. BY: ___ PURCH ___ MFR
○ RESISTANCE TEMP DETECTORS
○ RESISTANCE MAT'L ☐ ___ OHMS
○ SELECTOR SWITCH & IND. BY: ___ PURCH ___ MFR
○ LOCATION-JOURNAL BEARING
NUMBER ___ EA PD ___ EVERY OTH PAD ___ PER BRG
OTHER
○ LOCATION-THRUST BEARING
NO. (ACT) ___ EA PD ___ EVERY OTH PAD ___ PER BRG
OTHER
NO.(INACT) ___ EA PD ___ EVERY OTH PAD ___ PER BRG
OTHER
○ MONITOR SUPPLIED BY (5.4.7.5)
○ LOCATION ENCLOSURE
○ MFR ☐ MODEL
☐ SCALE RGE ☐ ALARM SET @ °C
○ SHTDOWN ☐ SET @ °C ○ TIME DLY SEC

REMARKS:

VIBRATION DETECTORS: (4.8.5.3) ○ SEE ATTACHED API-670 DATA SHEET

RADIAL VIBRATION DETECTORS

○ TYPE ◯ MODEL
◯ MFR
○ NO. AT EACH SHAFT BEARING TOTAL NO.
○ OSCILLATOR-DEMODULATOR SUPPLIED BY
○ MFR ☐ MODEL
○ MONITOR SUPPLIED BY (5.4.7.8.2)
○ LOCATION ENCLOSURE
○ MFR ☐ MODEL
☐ SCALE RGE ☐ ALARM SET @ uM
○ SHTDWN ☐ SET @ uM ○ TIME DELAY SEC

AXIAL POSITION DETECTOR (4.8.5.3): **NOT REQUIRED**

○ SEE ATTACHED API-670 DATA SHEETS
○ TYPE ◯ MODEL
◯ MFR ○ NO. REQUIRED
○ OSCILLATOR-DEMODULATOR SUPPLIED BY
○ MFR ☐ MODEL
○ MONITOR SUPPLIED BY (3.4.7.8.2)
○ LOCATION ENCLOSURE
○ MFR ☐ MODEL
☐ SCALE RGE ☐ ALARM SET @ uM
○ SHTDWN ☐ SET @ uM ○ TIME DELAY SEC

ACCELERATION TRANSDUCERS

○ SEE ATTACHED API-670 DATA SHEETS
● MFR Vibrometer Inc. ■ MODEL CE135
● LOCATION GG Casing ● NUMBER 3
● MONITOR SUPPLIED BY (3.4.7.8.4) Rolls-Royce
● LOCATION UCP ENCLOSURE
● MFR Bently-Nevada ■ MODEL 3500
☐ SCALE RGE ■ ALARM SET @ < 25 mm/s
● SHTDWN ■ SET @ 40 mm/s ● TIME DELAY 0 SEC

NOTES (1) FOR MULTIPLE SHAFT TURBINES, COMPLETE ALL APPLICABLE PORTIONS FOR EACH SHAFT
(2) FOR THREE BEARING SHAFTS, USE A SEPARATE SHEET FOR THE EXTRA BEARING
(3) FOR ROLLING ELEMENT BEARINGS, MODIFY ENTRIES AS REQUIRED. SHOW L-10 BEARING LIFE

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CONSTRUCTION FEATURES CONTINUED (NOTE 1)

RT61 POWER TURBINE

BEARINGS AND BEARING HOUSINGS (4.8)

RADIAL (NOTES 2 AND 3)	DISC	CPLG
TYPE	TILT PAD	TILT PAD
MANUFACTURER	KMC	Waukesha
LENGTH, mm	102	89
SHAFT DIAMETER, mm	254	203
~~UNIT~~ LOAD (ACT/ALLOW), kg	21129 / 65834	667 / 42569.0
BASE MATERIAL	Steel	Steel
BABBITT THICKNESS, mm	5.08	1.3
NO. PADS	4	4
LOAD: BETWEEN/ON PAD	Between	Between
PIVOT: CENTER/OFFSET, %	60	60
DAMPER BEARING	YES	NO

THRUST (NOTE 3)	ACTIVE	INACTIVE
TYPE	TILT PAD	Collar
MANUFACTURER	Waukesha (TYP)	Waukesha
~~UNIT~~ LOAD (ULTIMATE), kg		
~~UNIT~~ LOAD (SITE RATED), kg	19,047	N/A
~~UNIT~~ LOAD (MAX POTEN.), kg	50439	N/A
NO. OF PADS / AREA (mm^2)	9 / 86451	0 / N/A
BASE MATERIAL	Steel	Steel
BABBITT THICKNESS, mm		
PIVOT: CENTER/OFFSET, %		

LUBRICATION: ● FLOODED ○ DIRECTED
THRUST COLLAR: ○ INTEGRAL ● REPLACEABLE
BEARING MATERIAL

BEARING TEMPERATURE DEVICES (4.8.5.5) ○ SEE ATTACHED API-670 DATA SHEET

○ THERMOCOUPLES
○ SELECTOR SWITCH & IND. BY: PURCH MFR
● RESISTANCE TEMP DETECTORS
● RESISTANCE MAT'L Platinum ■ 100 OHMS
● SELECTOR SWITCH & IND. BY: PURCH X MFR
● LOCATION-JOURNAL BEARING
NUMBER 1 EA PD X EVERY OTH PAD 2 PER BRG
OTHER
● LOCATION-THRUST BEARING
NO. (ACT) 1 EA PD X EVERY OTH PAD 2 PER BRG
OTHER
NO.(INACT) X EA PD X EVERY OTH PAD 2 PER BRG
OTHER NONE REQUIRED
● MONITOR SUPPLIED BY (5.4.7.5) Rolls-Royce
● LOCATION TCP ENCLOSURE
● MFR RR Controls ■ MODEL
☐ SCALE RGE ■ ALARM SET @ 120 °C
● SHTDOWN ■ SET @ 130 °C ○ TIME DLY SEC
REMARKS:

VIBRATION DETECTORS: (4.8.5.3) ○ SEE ATTACHED API-670 DATA SHEET

RADIAL VIBRATION DETECTORS

● TYPE Non-Contacting ■ MODEL 3300 Series
■ MFR Bently-Nevada
● NO. AT EACH SHAFT BEARING 2 TOTAL NO. 4
● OSCILLATOR-DEMODULATOR SUPPLIED BY Rolls-Royce
● MFR Bently-Nevada ■ MODEL 3300 Series
● MONITOR SUPPLIED BY (5.4.7.8.2) Rolls-Royce
● LOCATION TCP ENCLOSURE
● MFR Bently Nevada ■ MODEL 3500 Series
☐ SCALE RGE ■ ALARM SET @ 60 uM
● SHTDWN ■ SET @ 90 uM ○ TIME DELAY SEC

AXIAL POSITION DETECTOR (4.8.5.3):

○ SEE ATTACHED API-670 DATA SHEETS
● TYPE Non-Contacting ● MODEL 3300 Series
● MFR Bently-Nevada ● NO. REQUIRED 2
● OSCILLATOR-DEMODULATOR SUPPLIED BY Rolls-Royce
● MFR Bently-Nevada ■ MODEL 3300 Series
● MONITOR SUPPLIED BY (3.4.7.8.2) Rolls-Royce
● LOCATION TCP ENCLOSURE
● MFR Bently Nevada ■ MODEL 3500 Series
☐ SCALE RGE ■ ALARM SET @ +/-125 uM
● SHTDWN ■ SET @ +/-200 uM ○ TIME DELAY SEC

ACCELERATION TRANSDUCERS **NOT REQUIRED**

○ SEE ATTACHED API-670 DATA SHEETS
○ MFR ☐ MODEL
○ LOCATION ○ NUMBER
○ MONITOR SUPPLIED BY (3.4.7.8.4)
○ LOCATION ENCLOSURE
○ MFR ☐ MODEL
☐ SCALE RGE ☐ ALARM SET @ G
○ SHTDWN ☐ SET @ G ○ TIME DELAY SEC

NOTES (1) FOR MULTIPLE SHAFT TURBINES, COMPLETE ALL APPLICABLE PORTIONS FOR EACH SHAFT
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(3) FOR ROLLING ELEMENT BEARINGS, MODIFY ENTRIES AS REQUIRED. SHOW L-10 BEARING LIFE

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UTILITIES: CONNECTIONS

UTILITY CONDITIONS: N/A N/A

STEAM:	AUXILIARY DRIVERS		HEATING	
INLET MIN	kPag	°C	kPag	°C
NORM	kPag	°C	kPag	°C
MAX	kPag	°C	kPag	°C
EXHST MIN.	kPag	°C	kPag	°C
NORM	kPag	°C	kPag	°C
MAX	kPag	°C	kPag	°C
	STARTING	N/A	INJECTION	N/A
INLET MIN	kPag	°C	kPag	°C
NORM	kPag	°C	kPag	°C
MAX	kPag	°C	kPag	°C
EXHST MIN.	kPag	°C		
NORM	kPag	°C		
MAX	kPag	°C		

ELECTRICITY: (5.4.6.1) PILOT LIGHT INDICATORS

	MOTORS	HEATING	CONTROL	SHUTDOWN
VOLTAGE	400	230	230	230
HERTZ	50	50	50	50
PHASE	3	1	1	1

COOLING WATER:
INLET TEMP. °C MAX RETURN °C
DESIGN TEMPERATURE °C
NORM PRESS kPag MIN RETURN kPag
DESIGN PRESS kPag MAX ALLOW D P kPaD
WATER SOURCE
INSTRUMENT AIR PRESSURE DESIGN, kPag
MAX 1000 NORMAL 790 MIN 650

REMARKS:

TOTAL UTILITY CONSUMPTION:

COOLING WATER				m³/HR
STEAM LEVEL	N/A kPag	kPag	kPag	kPag
STEAM, NORMAL	N/A			kg/HR
STEAM, MAX	N/A			kg/HR
INSTRUMENT AIR	See Utility List in Proposal			Nm³/HR
MOTORS (AUXILIARIES)	See Utility List in Proposal			kW
BATTERY CHARGERS	See Utility List in Proposal			kW
HEATERS	See Utility List in Proposal			kW
PURGE (AIR OR N_2)	See Utility List in Proposal			Nm³/HR

TURBINE AIR EXTRACTION REQUIRED: (4.1.22)
Nm³/HR @ kPag
MAXIMUM PRESSURE AVAILABLE kPag
MINIMUM SPEED RPM
DISCHARGE TEMPERATURE °C
COMPRESSOR EXTRACTION STAGE NUMBER

REMARKS:
FOR FULL DETAILS OF UTILITY REQUIREMENTS
OF THIS GAS TURBINE PACKAGE PLEASE REFER
TO THE UTILITY SCHEDULE ATTACHED UNDER
TECHNICAL PROPOSAL.

PURCHASER CONNECTIONS

CONNECTION	DESIGN APPROVAL REQ'D (4.10.4.6.4)	SIZE	FACING and RATING	POSITION (4.4.1)	FLANGED OR STUDDED (4.4.1)	MATING FLG & GASKET BY VENDOR (4.4.5.4)	GAS VELOCITY m/SEC
INLET	No			TOP / SIDE			
EXHAUST	No			TOP			
GAS FUEL SUPPLY	No	2"	600# RF		Flanged	Yes	
STEAM	N/A			N/A			
WATER	N/A			N/A			
GAS FUEL VENT	No	1"	150# RF		Flanged		
AUXILIARY AIR SUPPLY	No	0.75"	FNPT				

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INSTRUMENTS

DESCRIPTION	INSTRUMENT TYPE		INSTRUMENT LOCATION			TRANS-MITTERS FURNISHED BY		CONTROL ROOM RECEIVERS FURN BY	
	INDICATING	RECORDING	LOCAL	LOCAL PANEL	CONTROL ROOM	VENDOR	OTHERS	VENDOR	OTHERS
GAS GENERATOR ~~OR SINGLE SHAFT GAS TURBINE~~									
TACHOMETER(S) (NO. 2)	●	●	○	○	●	●	○	●	○
Δ P AIR INLET SYSTEM	●	○	●	○	●	●	○	●	○
COMPRESSOR DISCHARGE PRESSURE	●	○	○	●	●	●	○	●	○
FUEL FILTER Δ P	○	○	○	○	○	○	○	○	○
FUEL SUPPLY PRESSURE	●	○	○	○	●	●	○	●	○
STARTING GAS SUPPLY PRESSURE	●	○	○	●	○	○	○	○	○
STARTING GAS EXHAUST PRESSURE	○	○	○	○	○	○	○	○	○
TEMP COMBUSTOR MEASUREMENT (6 PTS MIN) 4.3.2)	●	●	○	○	●	●	○	●	○
TEMP GAS TURB CONTROL PLANE (6 PTS MIN)	○	○	○	○	○	○	○	○	○
INLET AIR TEMPERATURE	●	●	●	○	●	●	○	●	○
TEMPERATURE GG COMPRESSOR DISCHARGE	●	●	○	○	●	●	○	●	○
TEMPERATURE THRUST BEARING OIL DRAIN	○	○	○	○	○	○	○	○	○
TEMPERATURE EACH BEARING SUMP (ROLLING ELEMENT TYPE)	○	○	○	○	○	○	○	○	○
TEMPERATURE FUEL ~~MANIFOLD~~ **GAS SUPPLY**	●	○	○	○	●	●	○	●	○
TEMPERATURE LUBE OIL RESERVOIR	●	○	○	○	●	●	○	●	○
FIRED HOUR METER	●	●	○	○	●	●	○	●	○
A) NUMBER STARTS COUNTER	●	○	○	○	●	●	○	●	○
B) START SEQUENCE TIMER	●	○	○	○	●	●	○	●	○
LUBE OIL RESERVOIR LEVEL	●	○	●	○	●	●	○	●	○
LUBE OIL PUMP PRESSURE INDICATORS (NO 2)	●	○	○	●	○	○	○	○	○
LUBE OIL COOLER OIL INLET TEMPERATURE	○	○	○	○	○	○	○	○	○
LUBE OIL COOLER OIL OUTLET TEMPERATURE	●	○	○	○	●	●	○	●	○
LUBE OIL COOLER COOLANT INLET TEMPERATURE	○	○	○	○	○	○	○	○	○
LUBE OIL COOLER COOLANT OUTLET TEMPERATURE	○	○	○	○	○	○	○	○	○
LUBE OIL FILTER Δ P	●	○	○	●	○	●	○	●	○
LUBE OIL PRESSURE EACH LEVEL (NO. 1)	●	○	○	●	●	●	○	●	○
CONTROL OIL PRESSURE	●	○	○	●	●	●	○	●	○
SITE FLOW INDICATOR EACH DRAIN (NO. N/A)	○	○	○	○	○	○	○	○	○
INLET GUIDE VANE POSITION INDICATOR	●	○	○	○	●	●	○	●	○
EXHAUST DUCT Δ P INDICATOR	○	○	○	○	○	○	○	○	○
ENCLOSURE COOLING AIR EXHAUST TEMPERATURE	●	○	○	○	●	●	○	●	○
POWER TURBINE									
TACHOMETER(S) (NO. 1)	●	○	○	○	●	●	○	●	○
EXHAUST TEMPERATURE (2 PTS MIN)	○	○	○	○	○	○	○	○	○
JOURNAL BEARING TEMPERATURE	●	○	○	○	●	●	○	●	○
THRUST BEARING TEMPERATURE	●	○	○	○	●	●	○	●	○
BEARING DRAIN TEMPERATURE	○	○	○	○	○	○	○	○	○
SITE FLOW INDICATOR EACH DRAIN (NO. 1 COMMON)	●	○	●	○	○	○	○	○	○
LUBE OIL INLET PRESSURE	●	○	○	●	●	○	○	●	○
LUBE OIL INLET TEMPERATURE	○	○	○	○	○	○	○	○	○

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ALARMS AND SHUTDOWNS (5.4.4)

DESCRIPTION	APPLIES TO: ~~SINGLE SHAFT~~ OR G.G.	APPLIES TO: SEP PWR TURB.	(5.4.4.8.5) ANNUNCIATOR POINT IN VENDOR FURNISHED CONTROL PANEL (1): ALARM	(5.4.4.8.5) ANNUNCIATOR POINT IN VENDOR FURNISHED CONTROL PANEL (1): SHUT-DOWN	SENSING DEVICES TO BE FURNISHED BY: VENDOR	SENSING DEVICES TO BE FURNISHED BY: OTHERS	INDICATING LIGHT ONLY (2)
RADIAL SHAFT VIBRATION (NO. 4)	○	●	●	●	●	○	☐
AXIAL THRUST POSITION (NO. 2)	○	●	●	●	●	○	☐
OVERSPEED (1) (NO. 3)	○	●	○	●	●	○	☐
CASING VIBRATION (NO. 3)	●	○	●	●	●	○	☐
HIGH THRUST BEARING TEMP	○	●	●	●	●	○	☐
HIGH RADIAL BEARING TEMP	○	●	●	●	●	○	☐
LOW FUEL SUPPLY PRESSURE	●	○	●	○	●	○	☐
HIGH FUEL FILTER Δ P	○	○	○	○	○	○	☐
GAS TURBINE TEMPERATURE SPREAD HIGH	●	○	●	●	●	○	☐
EXHAUST OVER TEMP	●	○	●	●	●	○	☐
FAILURE OF OVER-TEMP SHUTDOWN DEVICE	○	○	○	○	○	○	☐
HIGH INLET AIR Δ P EACH FILTER	●	○	●	●	●	○	☐
COMBUSTOR FLAME-OUT (GG UNDERSPEED)	●	○	○	●	●	○	☐
CHIP DETECTOR, ANTI FRICTION BEARING	○	○	○	○	○	○	☐
FAILURE STARTING CLUTCH TO ENGAGE OR DISENGAGE	●	○	○	●	●	○	☐
LOW OIL PRESSURE (NO. 2)	●	●	●	●	●	○	☐
HIGH LUBE OIL TEMP	●	●	●	●	●	○	☐
LOW LUBE OIL RESERVOIR LEVEL	●	●	●	○	●	○	☐
HIGH LUBE OIL RESERVOIR LEVEL	●	○	●	○	●	○	☐
HIGH OIL FILTER Δ P (NO. 2)	●	●	●	○	●	○	☐
LUBE OIL SPARE PUMP OPERATING	●	●	●	○	○	●	☐
LOW CONTROL OIL PRESSURE	●	○	●	●	●	○	☐
LOW STARTING GAS PRESSURE	○	○	○	○	○	○	☐
ANTI-ICING SYSTEM - NOT OPERATING			○	○	○	○	☐
LOW D.C. VOLTAGE	○	○	○	○	○	○	☐
EMERGENCY D.C. PUMP OPERATING	○	○	○	○	○	○	☐
RESERVOIR HEATER "ON"			○	○	○	○	☐
IMPLOSION DOOR OPEN			○	○	○	○	☐
EXTERNAL PERMISSIVE START SIGNAL	●		●	○	○	●	☐
EXTERNAL SHUTDOWN SIGNAL	●		○	●	○	●	☐
LOSS OF AUX COOLING AIR	○		○	○	○	○	☐
LAMP TEST PUSH BUTTON	○		○	○	○	○	☐
ENCLOSURE HIGH TEMPERATURE	●	●	●	●	●	○	☐
CONTROL SIGNAL FAILURE	●	●	○	●	●	○	☐
CONTROL SYSTEM ACTUATOR FAILURE	●	○	○	●	●	○	☐
GOVERNOR FAILURE	●	●	○	●	●	○	☐
ENCLOSURE VENT FAN FAILURE	●	●	○	●	●	○	☐
	○	○	○	○	○	○	☐

NOTES: (1) VENDOR TO ADVISE METHOD OF ANNUNCIATION
(2) VDU MAY USE MESSAGE INDICATOR

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ACCESSORIES SUPPLIED BY GAS TURBINE MANUFACTURER

STARTING AND HELPER DRIVERS 5.1)

● STARTER ONLY (5.1.1.2) ○ STARTER/HELPER (5.1.1.3)
TYPE (5.1.1.1) ● MOTOR ○ STEAM TURBINE
○ GAS EXPANDER ○ IC ENGINE ● HYDRAULIC
○ GAS TURBINE ■ STARTER IS CLUTCHED (5.1.1.7)
○ HELPER RATING (5.1.2.2) kW
☐ STARTER RATING (5.1.2.1) kW
◎ SHAFT TURNING DEVICE REQUIRED (5.1.3.1)

■ MOTOR
TYPE RATING 185 kW
MFR MODEL

☐ STEAM TURBINE (REFERENCE API DATA SHEETS)
MFR MODEL
kW MAX. STEAM FLOW kg/HR
TOTAL/START kg

☐ GAS EXPANDER
APPLICABLE SPEC. (5.1.1.6)
MFR MODEL
kW MAX. GAS FLOW kg/HR
TOTAL/START kg
○ GAS FOR EXPANSION TURBINE:

	MIN	MAX	NORMAL
INLET PRESSURE, (kPa)			
EXHAUST PRESS, (kPa)			
GAS TEMP., °C INLET			
GAS TEMP., °C EXHAUST			
MOLECULAR WEIGHT			

SPEED CONTROL ○ GOVERNOR ○ PRESSURE REGULATOR

	YES	NO
INLET CONTROL VALVE FURNISHED		
STAINLESS STEEL PIPING MANIFOLD		
CARBON STEEL FLANGES		
Y-STRAINER W/BREAKOUT FLANGES		
LOW SPEED CAPABILITY (FOR COMPRESSOR CLEANING)		

RELIEF VALVE PRESSURE SET POINT kPag
CASING MATERIAL
SEAL TYPE

☐ INTERNAL COMBUSTION ENGINE
TYPE ○ SPARK IGNITED ○ DIESEL
APPLICABLE SPECIFICATION (5.1.1.6)
MFR MODEL
SPEED RPM POWER kW

☐ COMBUSTION GAS TURBINE
APPLICABLE SPEC (5.1.1.6)
MFR MODEL
SPEED RPM POWER kW

● GEARS: SEE SEPARATE API 613 GEAR DATA SHEETS (5.2.1.1)
● DRIVEN EQUIPMENT., SEE SEPARATE DATA SHEETS
■ FIRE PROTECTION EQUIPMENT (5.7.3.1)
TYPE ◎ HALON 1301 ◎ WATER MIST ◉ CO_2
● TYPE OF SENSOR ◎ NUMBER OF DETECTORS
● HEAT NUMBER 2
● INFRARED NUMBER 3
● INFRARED GAS DETECTORS NUMBER 8

MOUNTING PLATES (5.3)

TYPE (5.3.1.1) ○ SOLEPLATE ● BASEPLATE
☐ SHIM PACK THICKNESS mm (5.3.1.2.9)

BASEPLATE (5.3.2)

● FURNISHED BY Rolls-Royce (5.3.2.1)
● GAS TURBINE ONLY ○ EXTENDED FOR
◎ SUB-SOLEPLATES REQ'D (5.3.2.7) ○ DRIP RIM
○ COLUMN MOUNTING (5.3.2.4)(3-POINT) ○ LEVELING PADS (3.3.2.2)

ENCLOSURES (5.7.5)

● ENCLOSURE REQUIRED
REQUIREMENTS (5.7.5.1)
● ACOUSTICAL
● WEATHERPROOF
○ SAFETY
○ FIREPROTECTION
● POSITIVE VENTILATION (2 X 100%)

COUPLINGS AND GUARDS (5.2.2)

● SEE ATTACHED API-671 DATA SHEETS
☐ MANUFACTURER ■ TYPE Dry Flexible
☐ MODEL ☐ GUARD SUPPLIED BY
☐ MAXIMUM OUTSIDE DIAMETER mm
☐ HUB WEIGHT kg
☐ SPACER LENGTH mm ☐ SPACER WEIGHT kg
○ IDLING ADAPTER REQ'D ○ SOLO PLATE REQ'D
■ GUARD SUPPLIED BY Rolls-Royce
TYPE: ● FULLY ENCLOSED ○ SEMI-OPEN ○ OTHER
LUBRICATING REQUIREMENTS:
● NON-LUBE ○ GREASE ○ CONT. OIL LUBE
QUANTITY PER HUB kg or m³/HR

REMARKS:

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ACCESSORIES SUPPLIED BY GAS TURBINE MANUFACTURER

INLET SYSTEM

- (●) AIR FILTER (5.5.4.1) **UPDRAFT STATIC FILTER W/ PREFILTER WRAPS**
- ( ) INERTIAL TYPE SEPARATOR (●) MEDIA FILTERS
- (●) PREFILTER WRAP ( ) COMBINATION
- ( ) SELF CLEANING (PULSE TYPE)
- ( ) SINGLE STAGE WITH PROVISION FOR FUTURE EXTRA STAGES ( ) YES ( ) NO
- ( ) NORMAL DUST LOADING _____ kg/Nm³/HR
- (●) WIND DESIGN VELOCITY **44** m/sec
- ( ) SNOW LOAD _____ kg/m²
- (●) SEISMIC ZONE **NON-SEISMIC**
- LOCATION: ( ) GROUND LEVEL (●) ELEVATED (5.5.4.6)
- [ ] FILTRATION EFFICIENCY _____ % (5.5.4.3)
- [ ] MAINTENANCE INTERVAL _____ MONTHS
- [ ] CLEANING FREQUENCY _____ DAYS
- ( ) IMPLOSION DOOR (5.5.4.5)
- ( ) EVAPORATIVE COOLER (5.6.1.1) ( ) ANTI-ICING (5.5.3.10)
- ( ) LIQUID TO AIR EXCHANGER (5.6.2.2)
- ( ) WALKWAYS, LADDERS, HANDRAILS REQUIRED (5.6.1.5)
- (●) COMP CLEANING SYSTEM, TYPE **Crank Soak Wash** (5.5.3.9)
- (●) SILENCER PLATE ELEMENT MAT'L (5.5.5.1.4) **304 SST**
- [ ] FILTER MFR. _____ MODEL _____
  @ 110% RATED AIR FLOW Δ P _____ mm H_2O
  CLEAN _____ mm H_2O ALARM _____ mm H_2O
- [ ] COOLER MFR. _____ MODEL _____ Δ P _____ mm H_2O
- [ ] EXCHANGER MFR (5.6.2.3) _____
  MODEL _____ Δ P _____ mm H_2O
- [■] DUCTING GAUGE / MATERIAL _____ / **See remark-1**
- [ ] EXPANSION JOINT MFR _____ TYPE _____
- [ ] SILENCER MFR _____ Δ P _____ mm H_2O
- [ ] MANOMETER MFR _____ MODEL _____
  RANGE _____ mm H_2O
- [■] SYSTEM SITE RATED PRESSURE DROP **100** mm H_2O
  @ 110% RATED AIR FLOW

REMARKS 1. Combustion air intake inside skin -304SST, outside skid is carbon steel

EXHAUST SYSTEM

- ( ) EXTENT OF FURN. INSULATION (SEE SKETCH) (5.7.1.2)
- ( ) (RELIEF) (DIVERSION) VALVE (5.5.6.8)
- ( ) EXHAUST HEAT RECOVERY SYSTEM (5.5.3.1)
- ( ) EMISSION CONTROL SYSTEM (5.5.3.1)
- (●) EXHAUST SILENCER PLATE ELEMENT MATERIAL (5.5.5.2.3)
  CARBON STEEL W/ 409 SST FLOW LINER
- ( ) EMISSIONS SAMPLING SYSTEM (5.5.6.10)
- [ ] EXPANSION JOINT MFR _____ TYPE _____
- [ ] DUCTING GAUGE/MATERIAL _____ / _____
- [ ] SILENCER MFR _____ Δ P _____ mm H_2O
- [ ] HEAT RECOVERY DEVICE
  MFR _____ TYPE _____ Δ P _____ mm H_2O
  STEAM GEN: PRESS _____ kPag TEMP _____ °C
  RATE _____ kg/HR
- [ ] MANOMTR MFR _____ MODEL _____ RANGE _____ mm H_2O
- [ ] ATMOSPHERIC RELIEF DEVICE (5.5.6.8)
  TYPE _____ MFR _____ LOCATION _____
- [■] SYSTEM SITE RATED PRESSURE DROP **250** mm H_2O

ATMOSPHERIC EMISSIONS

- ( ) EMISSION SUPPRESSION SYSTEM REQUIRED (5.8.4.1)
- (●) NO_x REQUIREMENTS (5.5.3.1.1) 100PPMV @15% O2
- [ ] NO_x EMITTED _____

EMISSIONS REDUCTION METHOD (IF REQUIRED) (5.8.4.2)

- [◯] WATER INJECTION (5.8.4.4) [◯] SCR
- [◯] STEAM (5.8.4.4) [◯] DRY COMBUSTOR
- [◯] OTHER _____

- ( ) SO_x REQUIREMENTS _____
- ( ) SULFUR CONTENT OF FUEL _____
- [ ] SO_x EMITTED (BASED ON STATED SULFUR CONTENT) _____
- ( ) CO REQUIREMENTS _____
- [ ] CO EMITTED _____
- ( ) PARTICULATE REQUIREMENTS _____
- [ ] PARTICULATE EMITTED _____
- ( ) UNBURNED HC REQUIREMENTS _____
- [ ] UNBURNED HC EMITTED _____

APPLICABLE EMISSION CODES OR REGULATIONS

- ( ) EPA - TITLE 40 - CFR ( ) OTHERS _____

SPECIALIZED INSTRUMENTS

TACHOMETERS (5.4.7.2.2)
TYPE ( ) ELECTRICAL (●) ELECTRONIC
( ) ANALOG (●) DIGITAL
(●) MANUFACTURER **Rolls-Royce Controls**
( ) OIL FILLED PRESSURE GAUGES (5.4.7.6)

SWITCHES: (5.4.4.8.2)
CIRCUIT SHALL
( ) ENERGIZE (●) DEENERGIZE TO ALARM
( ) ENERGIZE (●) DEENERGIZE TO SHUTDOWN

ENCLOSURES
( ) EXPLOSION PROOF ( ) WEATHER PROOF

ENGINEERS INDIA LIMITED
NEW DELHI

COMBUSTION GAS TURBINE (API 616-4TH) DATA SHEET SI UNITS

SPEC NO. 6988-000-KA-MR-501(ITEM NO.
REVISION NO. 0 DATE 5-Apr-09
PAGE 10 OF 10 BY Leong, HT

REV

INSPECTION AND TESTING; LUBRICATION, WEIGHTS

SHOP INSPECTION AND TESTS: (6.1.1)

	REQ	WIT-NESSED	OBSER-VED
SHOP INSPECTION (6.1.2)	●		
CLEANLINESS (6.2.3.3)	●		
HYDROSTATIC (6.3.2)	●	○	○
MECHANICAL RUN (6.3.3)	●	●	○
☐ CONTRACT COUPLING ☐ IDLING ADAPTOR(S)			
■ CONTRACT PROBES ☐ SHOP PROBES			
VIBRATION PLOTS (6.3.3.3.4)	●		
TAPE RECORD VIB DATA (6.3.3.3.6)	○		
PERFORMANCE TEST (6.3.4.1) **(PTC-22)**	●	●	○
NO LOAD STRING TEST (ONE PER STATION)	●	●	○
PACKAGE TEST (6.3.4.2.1)	○	○	○
LOAD GEAR TEST (6.3.4.3)	○	○	○
NOISE SURVEY (6.3.4.4) (DURING STRING TEST)	●	●	○
AUXILIARY EQUIPMENT (6.3.4.5)	●	○	○
POST TEST INSPECTION (6.3.4.6)	○	○	○
UCP FAT	●	○	○
GOVERNOR RESPONSE TEST (6.3.4.8)	○	○	○
SPARE PARTS (6.3.4.9)	○	○	○
FIRE PROTECTION SIMULATION (6.3.4.10)	○	○	○
OTHER (6.3.4.11)	○	○	○

LUBRICATION SYSTEMS (4.9)

● SEE API 614 DATA SHEETS **MINERAL OIL SYSTEM**
☐ LUBE OIL VISCOSITY (4.9.8) ISO GRADE **ISO VG 32 / 46**
COMMON TO ☐ GAS GENERATOR/SINGLE SHAFT TURBINE
■ FREE POWER TURBINE ■ LOAD GEAR (IF APPLICABLE)
■ DRIVEN EQUIPMENT ☐ AUXILIARIES
○ (COMBINED) (SEPARATE) LUBE/SEAL SYSTEM (4.9.5)
● SYSTEM DESIGNED FOR SYNTHETIC LUBRICANT (4.9.2)
LUBE SPECIFICATION **Rolls-Royce Approved Synthetic Oil**
COMMON TO ■ GAS GENERATOR ☐ POWER TURBINE
☐ LOAD GEAR ☐ DRIVEN EQUIPMENT
☐ AUXILIARIES

■ OIL REQUIREMENTS	FLOW m³/HR	PRESSURE kPag	HEAT LOAD MJ/HR
GG	**FOR DETAILS OF THE PACKAGE**		
DRIVEN EQUIP.	**OIL REQUIREMENTS PLEASE**		
GEAR	**REFER TO THE FLUIDS SCHEDULE**		
COUPLINGS	**WITHIN TECHNICAL PROPOSAL.**		
POWER TURBINE			
TOTAL			

MOUNTING ARRANGEMENT
○ CONSOLE ○ COLONY ○ BASEPLATE

MATERIALS INSPECTION REQUIREMENTS (6.2.1.3)

○ SPECIAL CHARPY TESTING (4.10.5.3)
○ RADIOGRAPHY REQUIRED FOR
○ MAGNETIC PARTICLE REQUIRED FOR
○ LIQUID PENETRANT REQUIRED FOR
○ ULTRASONIC REQUIRED FOR
○ WELD INSPECTION (4.10.4.6.1)
○ WELDING HARDNESS TESTING (6.2.3.4)

MISCELLANEOUS:

● VENDOR'S REVIEW & COMMENTS ON PURCHASER'S PIPING & FOUNDATION (4.1.18)
● FINAL ASSEMBLY CLEARANCES (6.2.1.1.e)
● COORDINATION MEETING SITE (7.1.3) Supplier's Facility
○ SPEED-TORQUE CURVE (7.2.4-a)
○ INCREASE POWER FOR STEAM/WATER (7.2.4-b)
○ EFFECTS OF AMB. COND. ON EXHAUST FLOW (7.2.4-c)
○ RUN DOWN CURVES (7.2.4 d)
○ PURCHASER REVIEW OF CAMP./GOODMAN DIAG. (4.5.3.3)
○ VENDOR WITNESS ALIGNMENT (4.1.18)
● TECHNICAL DATA MANUAL (7.3.6.4)
○ NO OF PROPOSAL COPIES (7.2.1)

■ WEIGHTS

	DRY INSTALLED WT. (kg)	SHIPPING WT. (kg)	DIMEN LxWxH (m)
GG OR SS TURBINE	**FOR DETAILS OF THE PACKAGE**		
SS TURB. ROTOR	**WEIGHTS PLEASE REFER TO THE**		
POWER TURBINE	**GA DRAWING WITHIN TECHNICAL**		
P.T. ROTOR	**PROPOSAL.**		
LUBE SYSTEM			
DRIVEN EQUIP.			
FILTER			
INLET SILENCER			
EXHAUST SILENCER			
DUCTING			

MAX ERECTION WEIGHT (kg) ITEM
MAX MAINT. WEIGHT (kg) ITEM

REMARKS:

Rolls-Royce

eRB211 v6.1.4

31 March 2009

Customer: GAIL

Project: Pipeline Expansion Project

RB211-GT61

DLE Combustion

Site Conditions - Chainsa

Ambient Temp : 45degC

Altiude :197.8m

Relative Humidity : 84%

Fuel

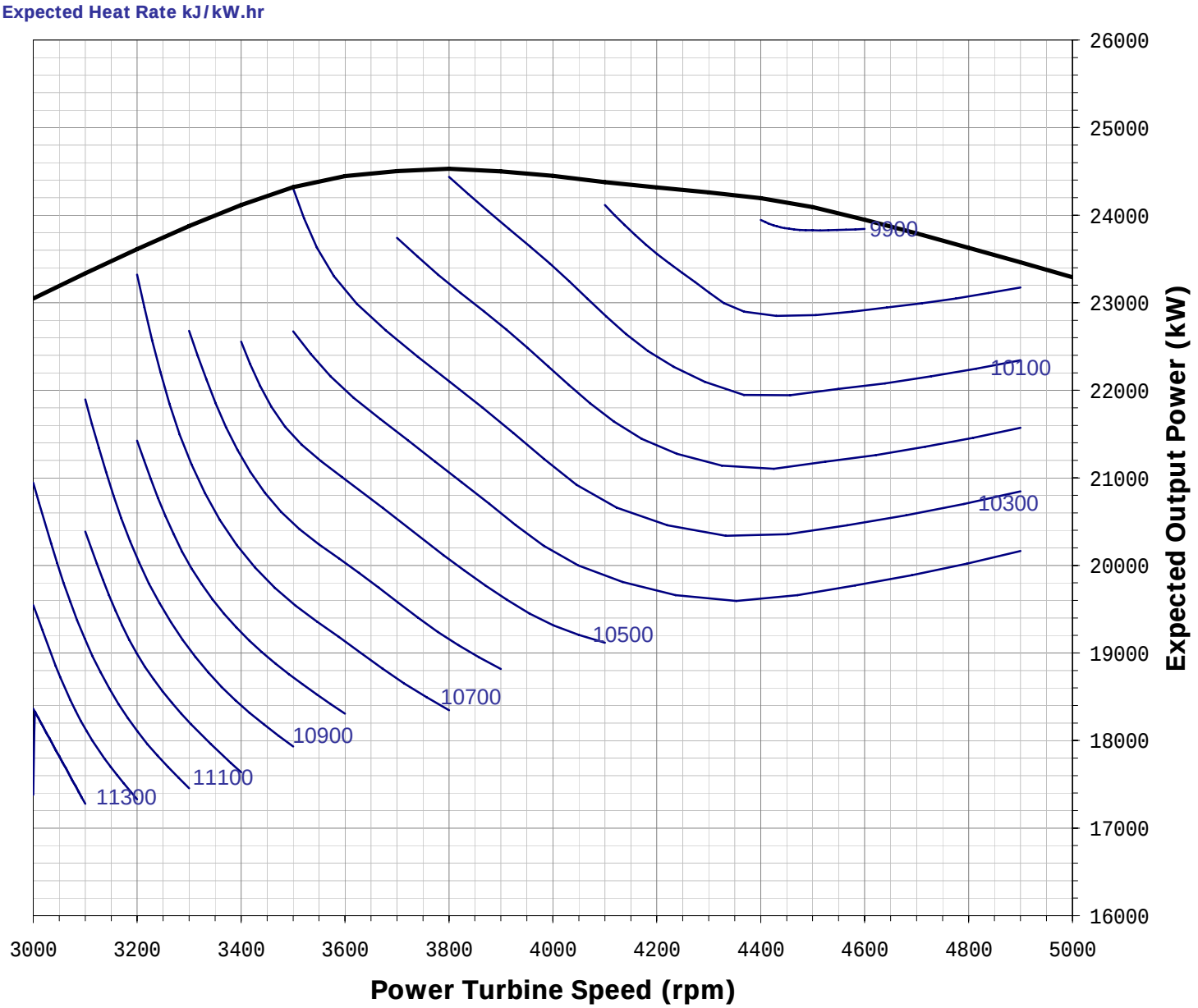
Fuel Type: Lean gas

Fuel LHV: 49602 kJ/kg

Installation Pressure Losses

Inlet: 100 mmH2O

Exhaust: 250 mmH2O



COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA -COMPRESSOR PACKAGE

OPERATING CASE: CHAINSA (Lean Gas, MW=17.07)

1.	**Compressor**			
1.1	BKW required at compressor input shaft including all losses (with 0% positive tolerance)	kW	:	20680 (GUARANTEED)
2.	**Gas Turbine Site Rating** Ú			
2.1	GT Site Rating @ 45EC (at compressor operating point speed)	kW	:	23546 (GUARANTEED)
3.	**Heat Rate at Site Conditions** (while generating rated BKW as at 1 above)			
	GT Heat rate @ 45EC (at compressor operating point speed)	kJ/kWh | kcal/kWh	:	10704 / 2557 (GUARANTEED)

3.1 Ú These figures correspond to the following site/operating conditions:

i)	Expected TBO (Hot Section)	hrs	:	25000
ii)	Expected TBO (Power Turbine)	hrs	:	50000
iii)	GG Rated Speed	rpm	:	6395 / 9326
iv)	PT Rated Speed	rpm	:	4850
v)	Gas Turbine ISO Rating (with losses below)	kW	:	31213
vi)	Site Altitude	m	:	197.8
vii)	Max. Inlet Loss (At Site)	mm H_2O	:	100
viii)	Max. Exhaust Loss (At site) with Heat recovery in future	mm H_2O	:	250
ix)	Site Rated/Temperature	EC	:	45
x)	Relative Humidity	%	:	84
xi)	GGT Inlet Temperature (GG Exit Temp) [While generating site rated power]	EC	:	801.8
Xii)	NHV of fuel gas (LHV)	kcal/Sm3	:	8565

4.	Overall compressor package noise level @ 1 meter from the equipment train (Including compressor, turbine and other aux. equipment & piping).	dBA	:	

(NOTE: - This is a typical data sheet. Bidder shall furnish data sheets filled for each operating case of each compressor station with Proposal).

COMPRESSOR STATION WORKS AT KAILARAS & CHAINSA -COMPRESSOR PACKAGE

OPERATING CASE: CHAINSA (Rich Gas, MW=17.4)

1.	**Compressor**			
1.1	BKW required at compressor input shaft including all losses (with 0% positive tolerance)	kW	:	20943
2.	**Gas Turbine Site Rating** Ú			
2.1	GT Site Rating @ 45EC (at compressor operating speed)	kW	:	23547
3.	**Heat Rate at Site Conditions** (while generating rated BKW as at 1 above)			
	GT Heat rate @ 45EC (at compressor operating point speed)	kJ/kWh | kcal/kWh	:	10176 / 2430

3.1

Ú These figures correspond to the following site/operating conditions:

i)	Expected TBO (Hot Section)	hrs	:	25000
ii)	Expected TBO (Power Turbine)	hrs	:	50000
iii)	GG Rated Speed	rpm	:	6396 / 9326
iv)	PT Rated Speed	rpm	:	4837
v)	Gas Turbine ISO Rating (with losses below)	kW	:	31199
vi)	Site Altitude	m	:	197.8
vii)	Max. Inlet Loss (At Site)	mm H_2O	:	100
viii)	Max. Exhaust Loss (At site) with Heat recovery in future	mm H_2O	:	250
ix)	Site Rated/Temperature	EC	:	45
x)	Relative Humidity	%	:	84
xi)	GGT Inlet Temperature (GG Exit Temp) [While generating site rated power]	EC	:	801.8
Xii)	NHV of fuel gas (LHV)	kcal/Sm3	:	8716

4.	Overall compressor package noise level @ 1 meter from the equipment train (Including compressor, turbine and other aux. equipment & piping).	dBA	:	

(NOTE: - This is a typical data sheet. Bidder shall furnish data sheets filled for each operating case of each compressor station with Proposal).

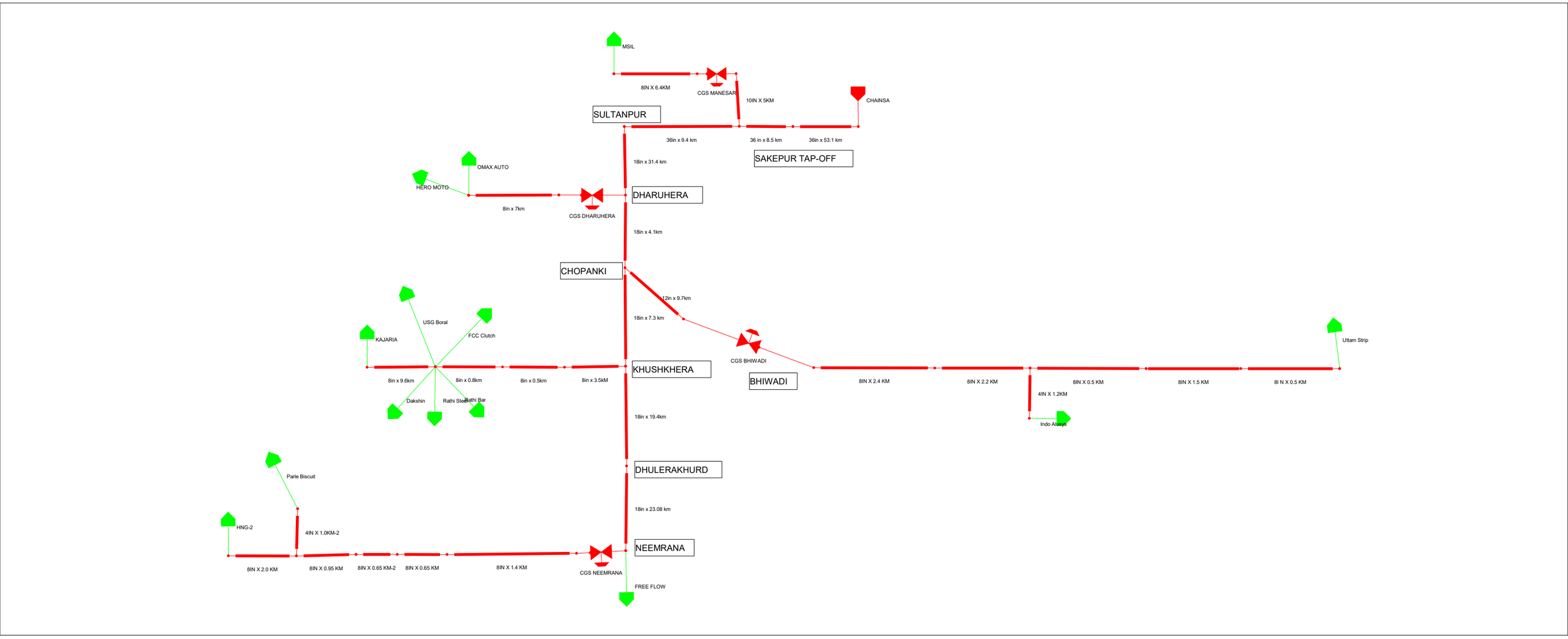
PERFORMANCE TABLE							
Sr No	**DESCRIPTION**	**UNITS**	**OPERATING CASE : CHAINSA (Lean Gas, MW=17.07)**				**Remarks**
			ISO	**Rated**	**Max**	**Min**	
1	Ambient temperature	ºC	15	45	45	0	
2	Relative humidity	%	60	84	84	37	
3	NHV of Fuel gas	kcal/kg	11847	11847	11847	11847	
4	Compressor Power at High speed Coupling (incl. Of mech. Seal losses)	kW	20680	20680	20680	20680	
5	Rated Speed of the Compressor	rpm	4850	4850	4850	4850	
6	Mech. Losses of Gas Turbine (Power to all auxiliaries)	kW	0	0	0	0	
7	Power Turbine Shaft speed	rpm	4850	4850	4850	4850	
8	Power required on Power Turbine Shaft [= (4) + (6)]	kW	20680	20680	20680	20680	
9	Site efficiency	%	35.31	33.63	33.63	35.75	
10	H_R: Heat Rate corresponding to (8)	kJ/kWh kcal/kWh	10195 2435	10704 2557	10704 2557	10069 2405	
11	$W_{max.}$: Max. Power on PT Shaft at corresponding shaft speed Site Elevation = 197.8 m **(As per site & Utility Data)** Max. Inlet pressure Losses = 100 mm H_2O Max. Exhaust Pressure Losses = 250 mm H_2O & Including all other losses	kW	31213	23546	23546	34837	
12	η_S corresponding to $W_{max.}$	%	38.76	35.38	35.38	39.68	
13	H_R corresponding to $W_{max.}$	kJ/kWh kcal/kWh	9289 2219	10176 2430	10176 2430	9072 2167	
14	T_S: PT Exhaust Temperature	ºC	451.9	520.0	520.0	416.9	
15	GG Exhaust Temp	ºC	698.5	774.0	774.0	656.9	
16	Firing Temp	ºC	Proprietary	Proprietary	Proprietary	Proprietary	
17	Exhaust Flow	kg/sec	78.1	71.5	71.5	81.3	
18	Actual Margin available with offered GT [= [{(11) – (8)}/(8)] * 100]	%	50.93	13.86	13.86	68.46	
	(NOTE: - This is a typical data sheet. Bidder shall furnish data sheets filled for each operating case of each compressor station with Proposal).						

PERFORMANCE TABLE							
Sr No	**DESCRIPTION**	**UNITS**	**OPERATING CASE : CHAINSA (Rich Gas, MW=17.4)**				**Remarks**
			ISO	**Rated**	**Max**	**Min**	
1	Ambient temperature	ºC	15	45	45	0	
2	Relative humidity	%	60	84	84	37	
3	NHV of Fuel gas	kcal/kg	11824	11824	11824	11824	
4	Compressor Power at High speed Coupling (incl. Of mech. Seal losses)	kW	20943	20943	20943	20943	
5	Rated Speed of the Compressor	rpm	4837	4837	4837	4837	
6	Mech. Losses of Gas Turbine (Power to all auxiliaries)	kW	0	0	0	0	
7	Power Turbine Shaft speed	rpm	4837	4837	4837	4837	
8	Power required on Power Turbine Shaft [= (4) + (6)]	kW	20943	20943	20943	20943	
9	Site efficiency	%	35.45	34.26	34.26	35.90	
10	H_R: Heat Rate corresponding to (8)	kJ/kWh kcal/kWh	10155 2425	10507 2510	10507 2510	10028 2395	
11	$W_{max.}$: Max. Power on PT Shaft at corresponding shaft speed Site Elevation = 197.8 m **(As per site & Utility Data)** Max. Inlet pressure Losses = 100 mm H_2O Max. Exhaust Pressure Losses = 250 mm H_2O & Including all other losses	kW	31199	23547	23547	34823	
12	η_S corresponding to $W_{max.}$	%	38.74	35.38	35.38	39.67	
13	H_R corresponding to $W_{max.}$	kJ/kWh kcal/kWh	9292 2219	10176 2430	10176 2430	9075 2168	
14	T_S: PT Exhaust Temperature	ºC	452.6	520.9	520.9	417.5	
15	GG Exhaust Temp	ºC	700.9	776.6	776.6	659.2	
16	Firing Temp	ºC	Proprietary	Proprietary	Proprietary	Proprietary	
17	Exhaust Flow	kg/sec	78.5	71.9	71.9	81.7	
18	Actual Margin available with offered GT [= [{(11) – (8)}/(8)] * 100]	%	48.97	12.43	12.43	66.28	
	(NOTE: - This is a typical data sheet. Bidder shall furnish data sheets filled for each operating case of each compressor station with Proposal).						

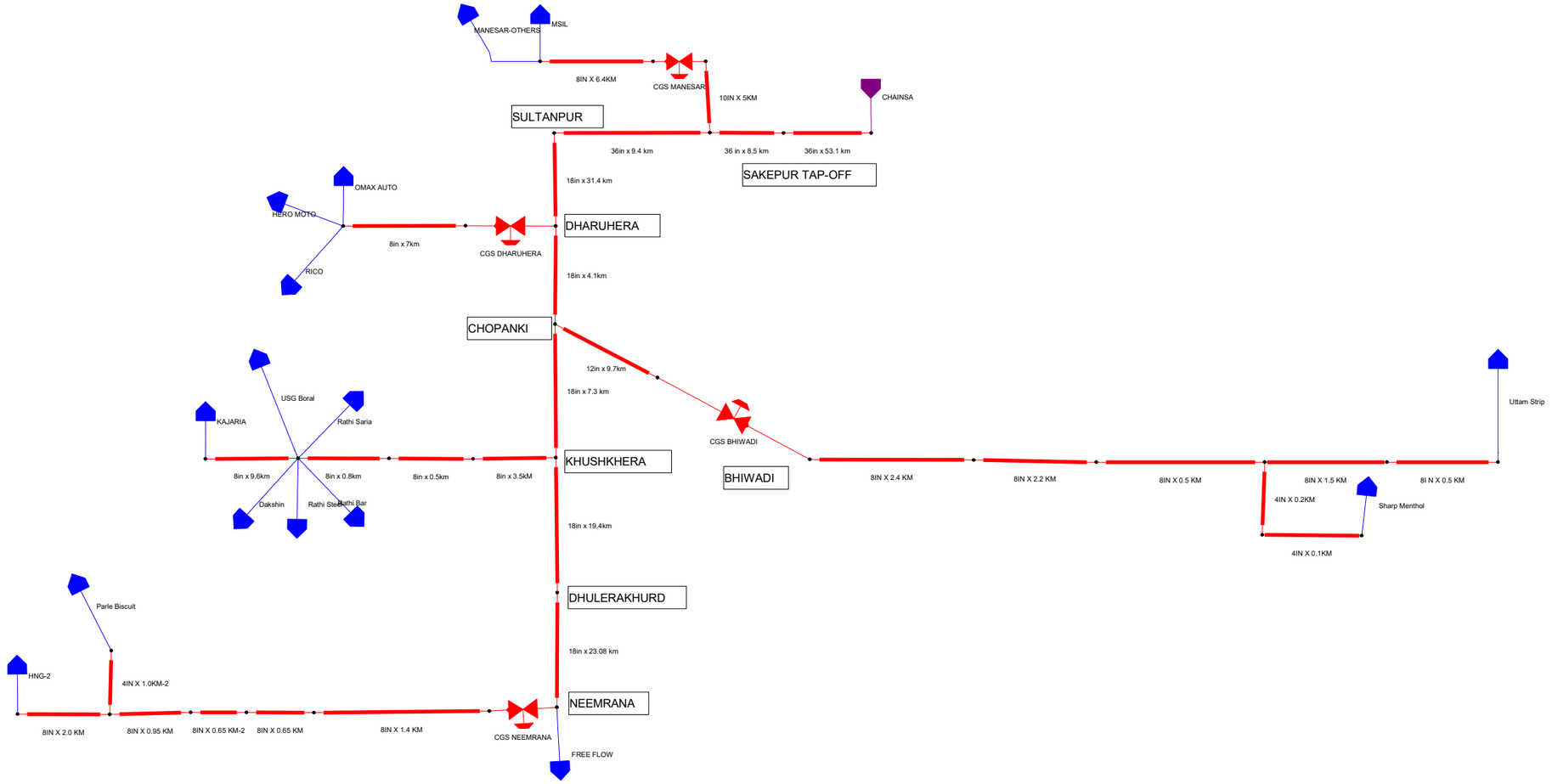
Tabulated below are the comparative capacity assessment figures (rounded-off figures) of CJHPL pipeline (at an interval of one year) carried out by entity & EIL:

Assessment years	Pipeline Capacity as determined by Entity (in MMSCMD)	Pipeline Capacity as assessed by EIL (in MMSCMD)	Remarks
	Entity	EIL	
	Software used - Pipeline Studio (TGNET)	Software used - Pipeline Studio (TGNET)	
2010-11	5.72	8.25	
2011-12	5.81	8.29	
2012-13	6.02	8.62	
2013-14	9.83	14.58	Addition of Chainsa Compressor at source & additional six consumers [Note-3]
2014-15	9.84	14.68	Change in network by addition of five consumers & two kms length
2015-16	9.71	14.7	Addition of two consumers in the network
2016-17	9.19	14.75	Addition of eleven consumers in the network
2017-18	9.19	14.75	
2018-19	9.93	14.78	
2019-20	10.22	12.63	Change in network by deletion of nine consumers & two kms length
2020-21	12.0	12.73	Sultanpur-Jhajjar-Hissar (135 km) was not considered as part of overall network [as not commissioned] [Note-4,5]
2021-22	12.0	12.73	
2022-23	9.87	13.2	23 no's of customers increased

** As the pipeline capacity was arrived as per PNGRB regulation [based on MAOP considerations], hence variation in determined capacity for various assessment years is due to change in sources and /or deliveries and / or network length and / or network configuration etc.


MSIL
8IN X 6.4KM
CGS MANESAR
10IN X 5KM
CHAINSA
SULTANPUR
36in x 9.4 km
36 in x 8.5 km
36in x 53.1 km
SAKEPUR TAP-OFF
18in x 31.4 km
OMAX AUTO
HERO MOTO
DHARUHERA
8in x 7km
CGS DHARUHERA
18in x 4.1km
CHOPANKI
12in x 9.7km
18in x 7.3 km
USG Boral
FCC Clutch
KAJARIA
CGS BHIWADI
Uttam Strip
KHUSHKHERA
8in x 9.6km
8in x 0.8km
8in x 0.5km
8in x 3.5KM
BHIWADI
8IN X 2.4 KM
8IN X 2.2 KM
8IN X 0.5 KM
8IN X 1.5 KM
8I N X 0.5 KM
4IN X 1.2KM
Dakshin
Rathi Steel
Rathi Bar
Indo Alusys
18in x 19.4km
DHULERAKHURD
Parle Biscuit
18in x 23.08 km
HNG-2
4IN X 1.0KM-2
NEEMRANA
8IN X 2.0 KM
8IN X 0.95 KM
8IN X 0.65 KM-2
8IN X 0.65 KM
8IN X 1.4 KM
CGS NEEMRANA
FREE FLOW

CJPL_PNGRB11-12



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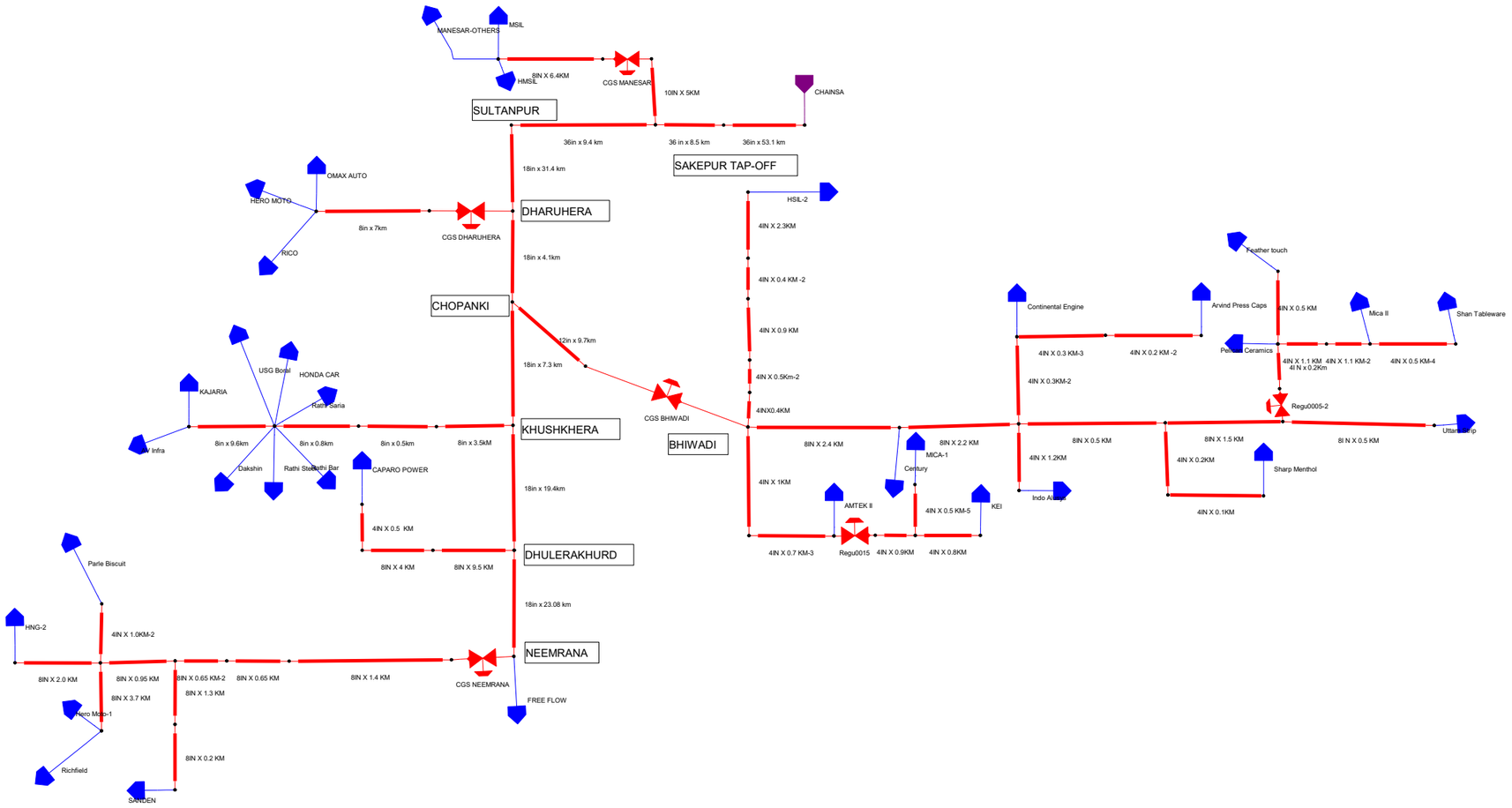

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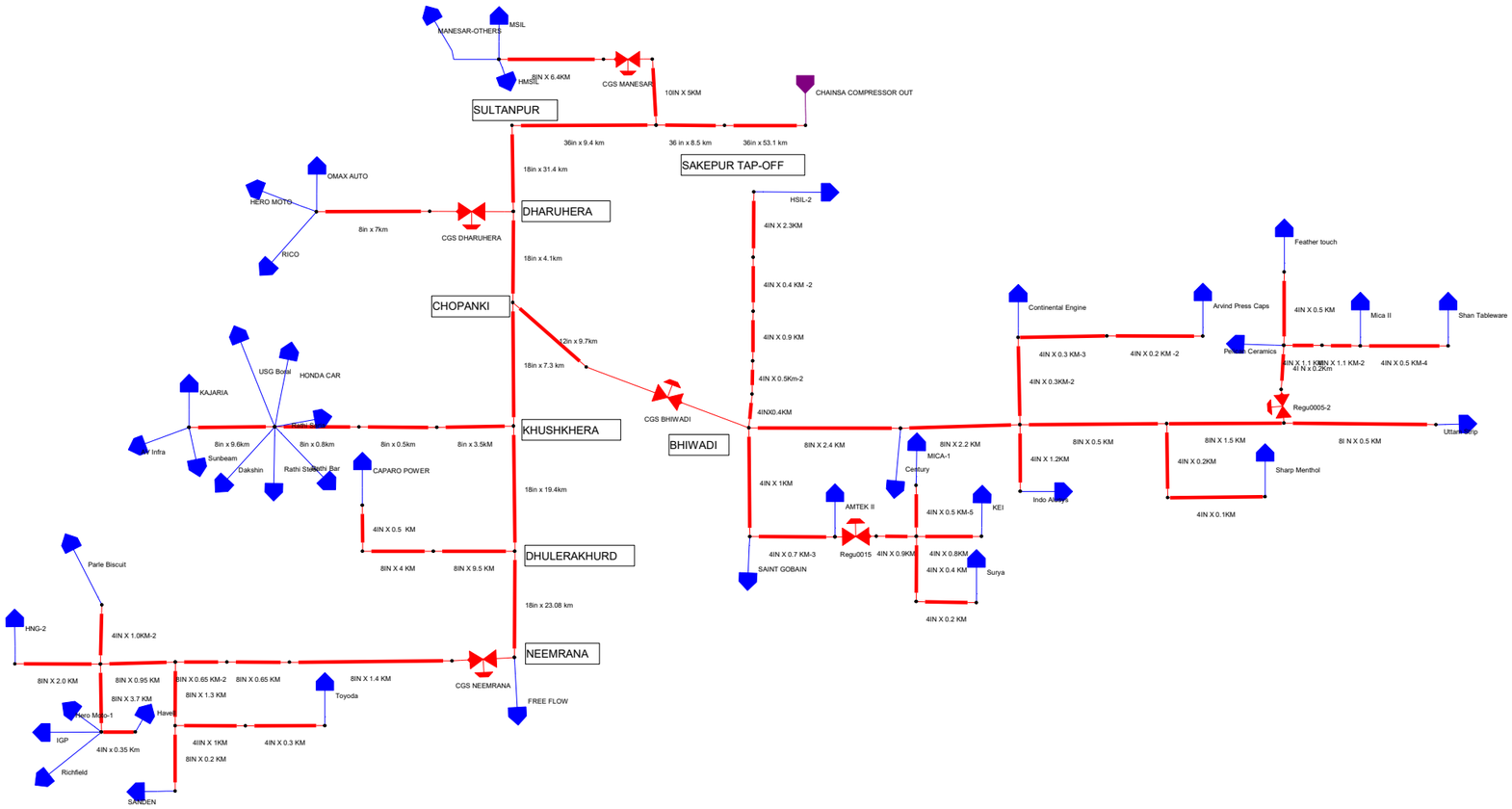

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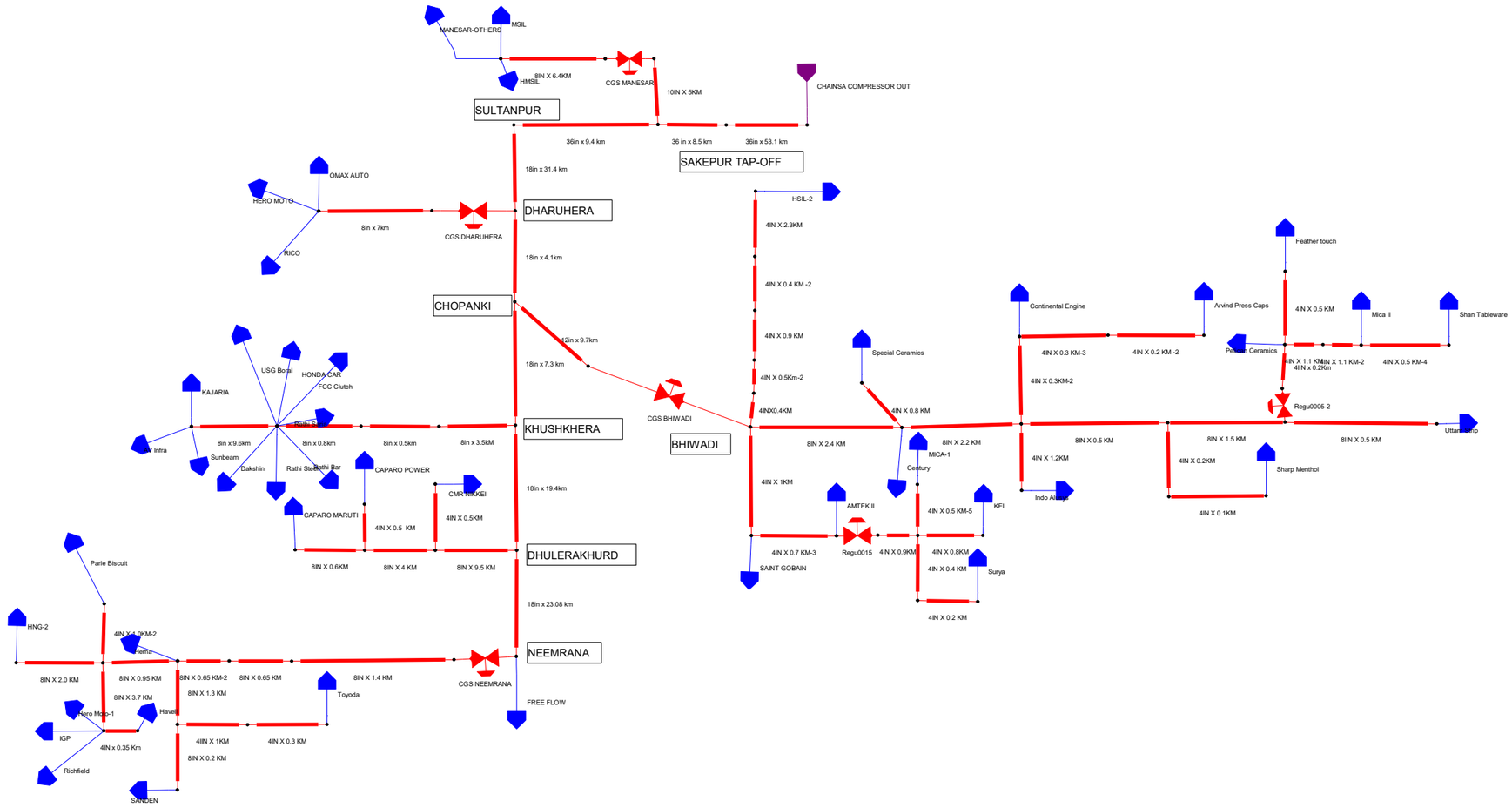

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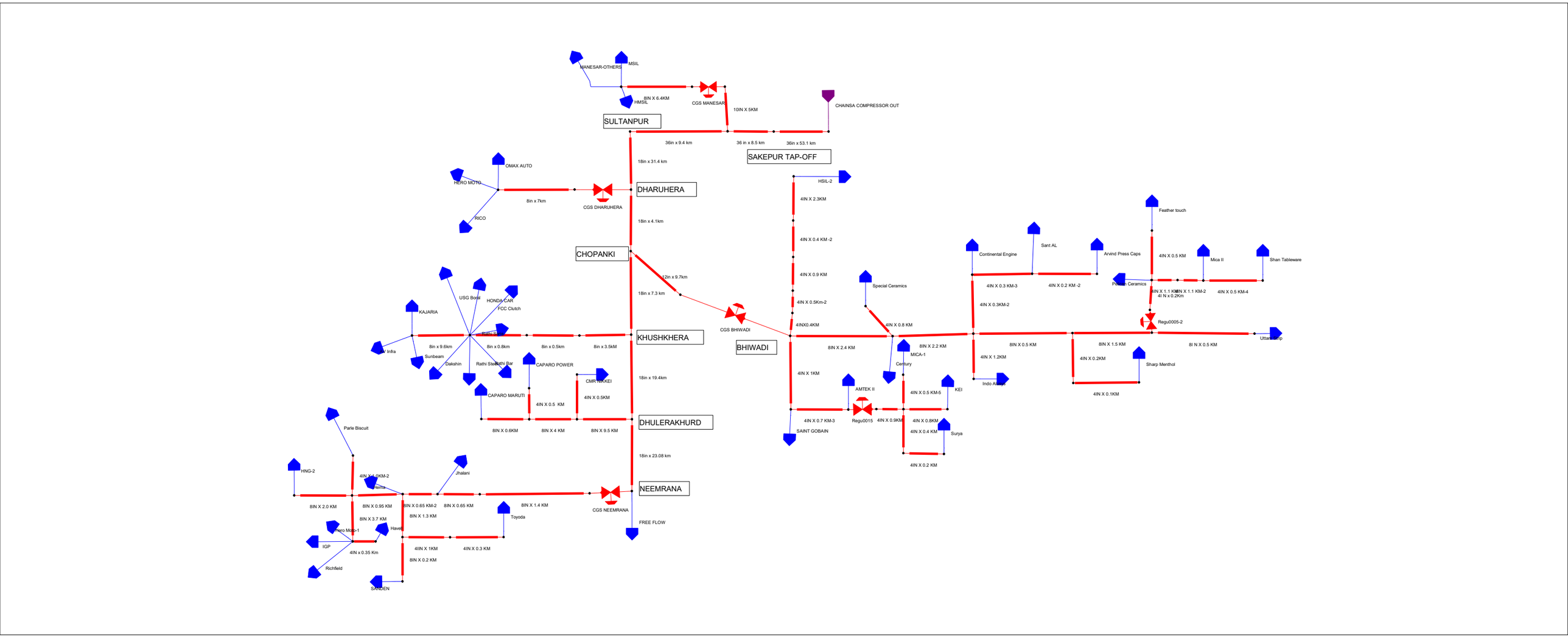

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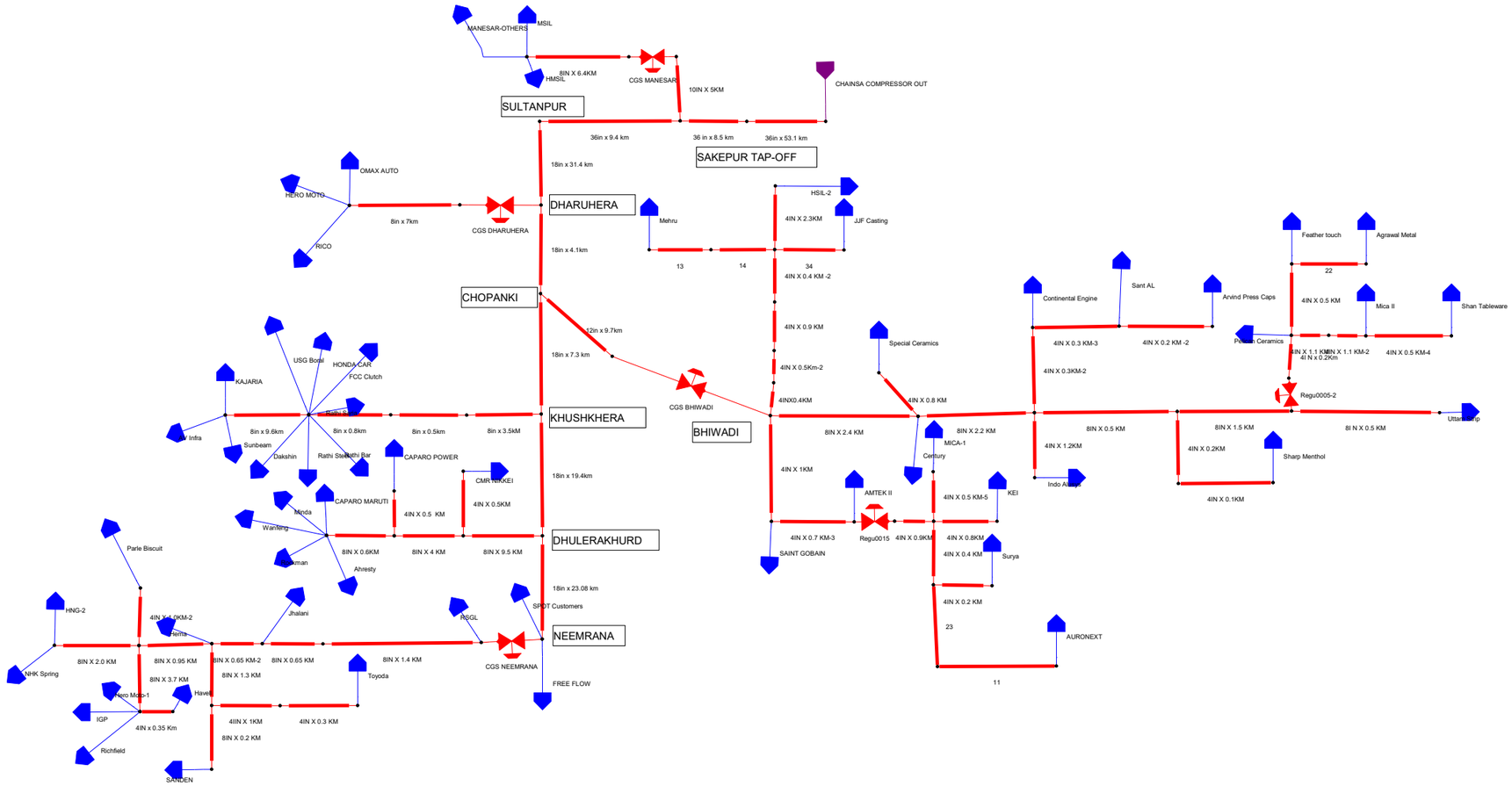

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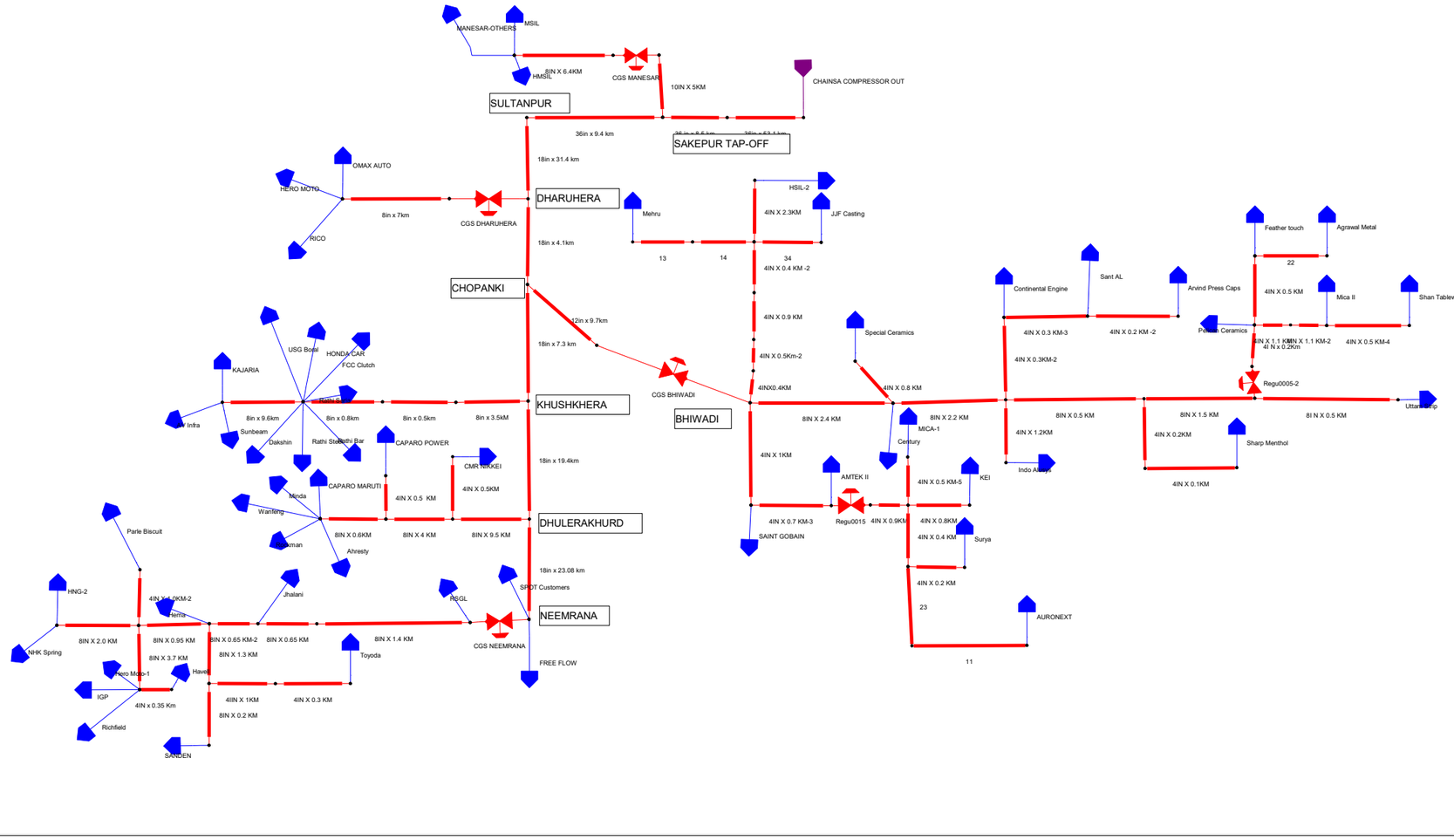

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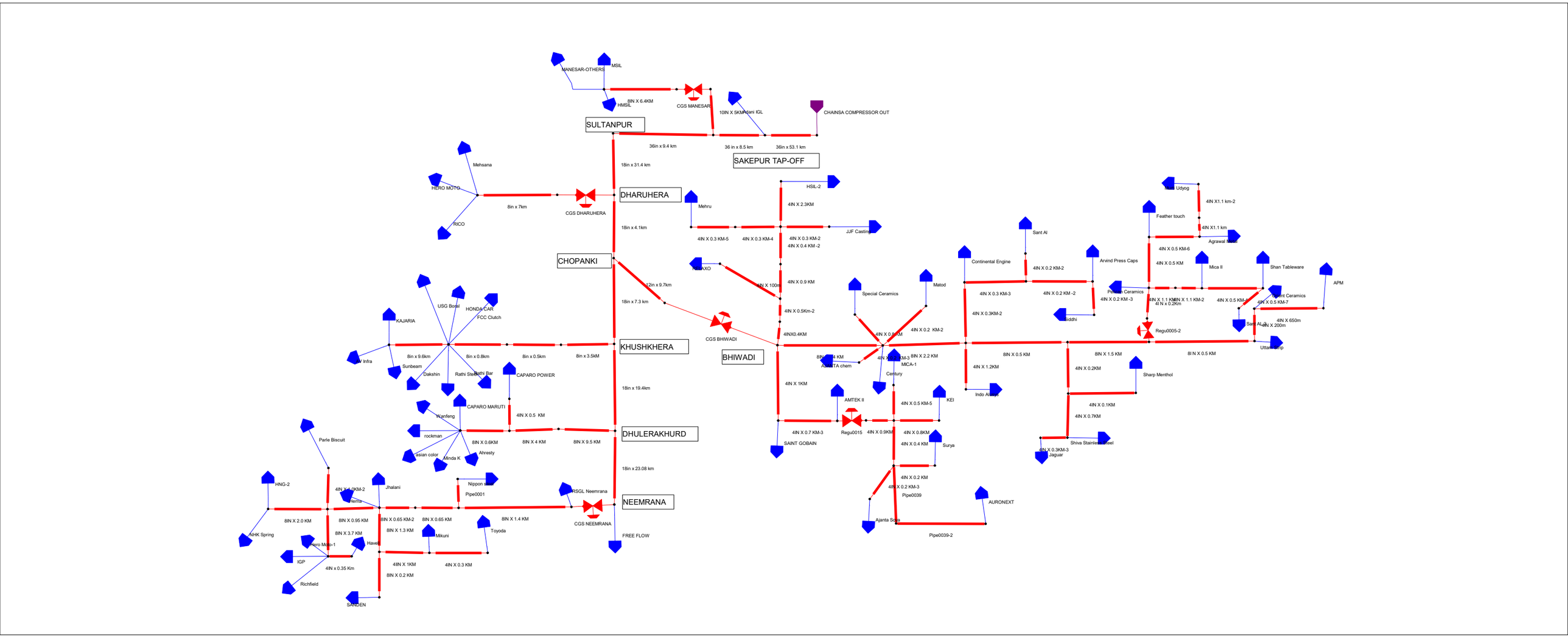

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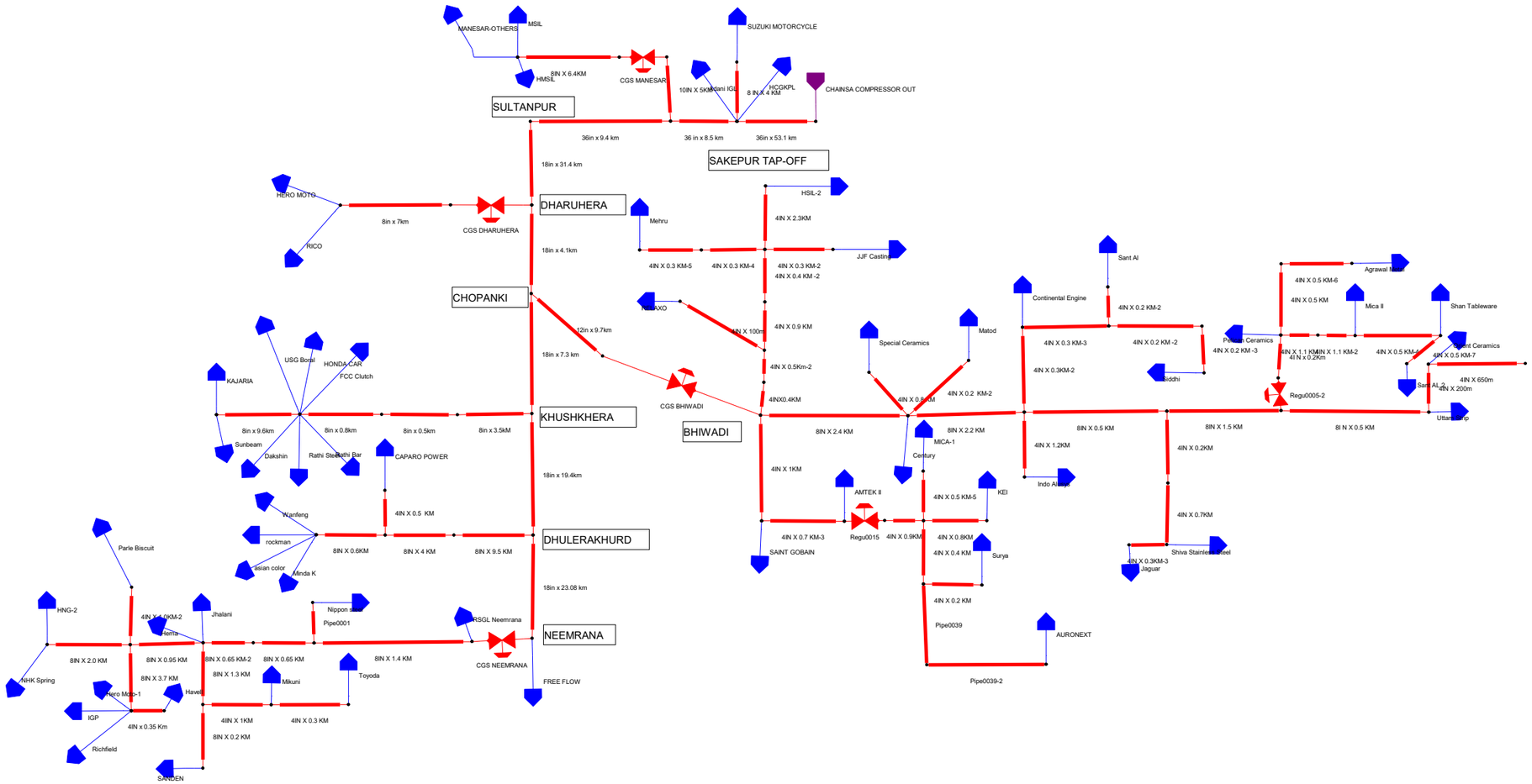

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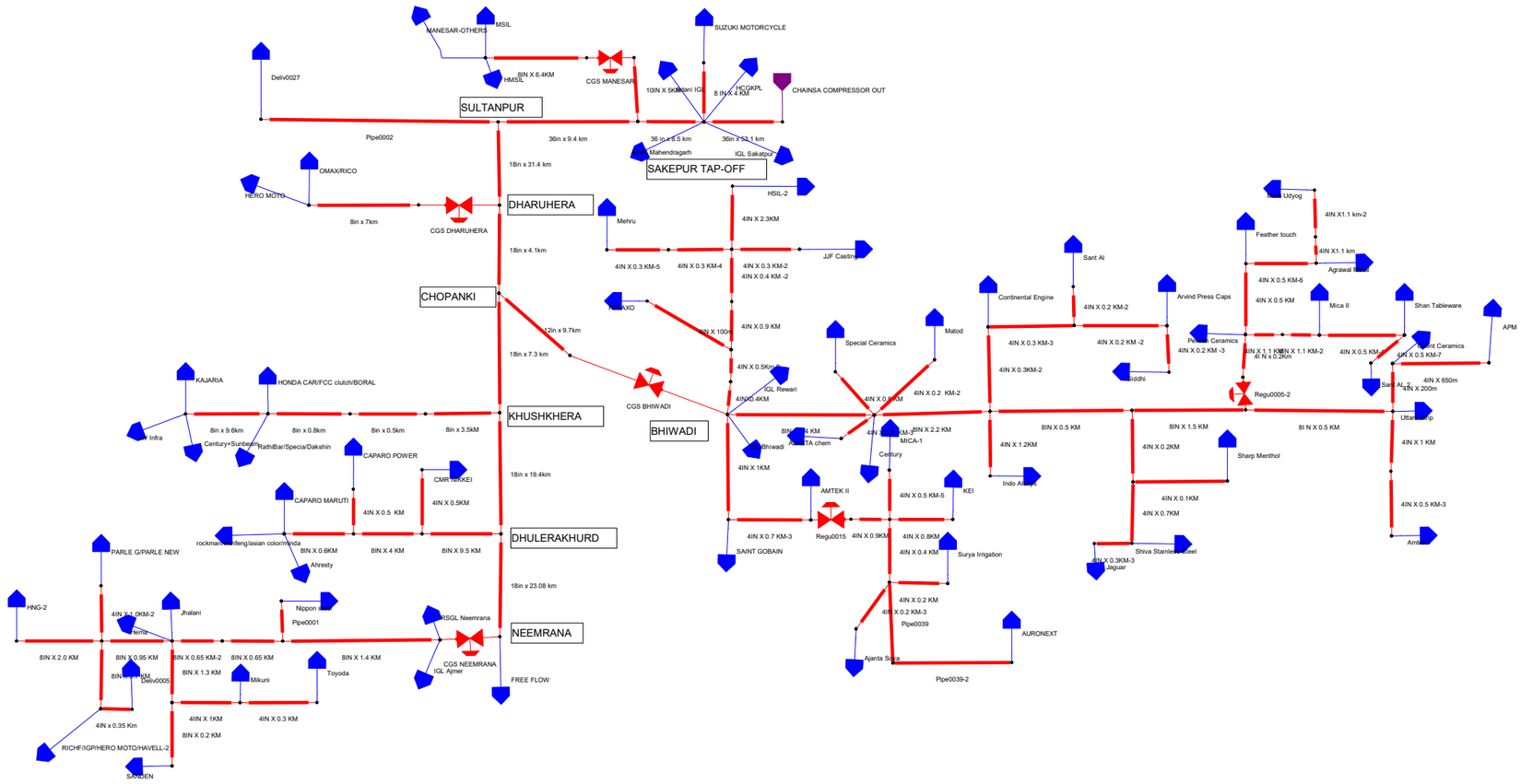

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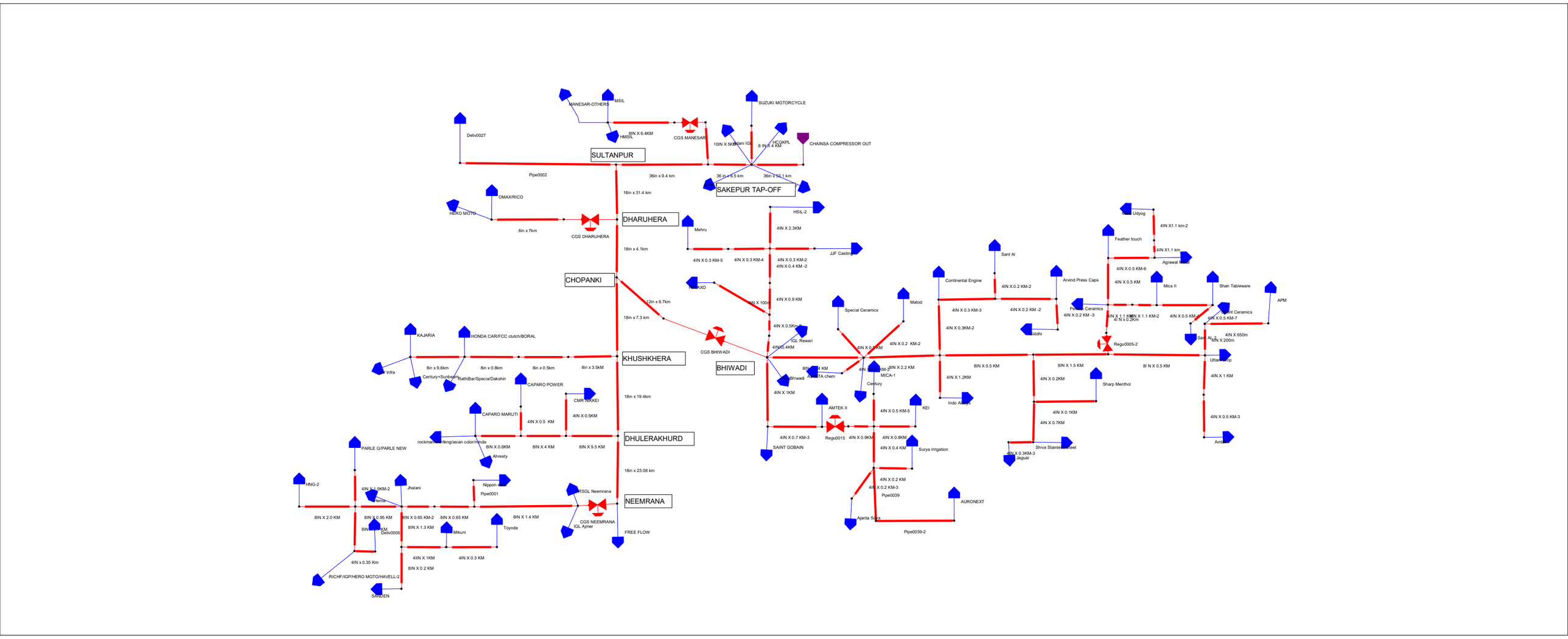

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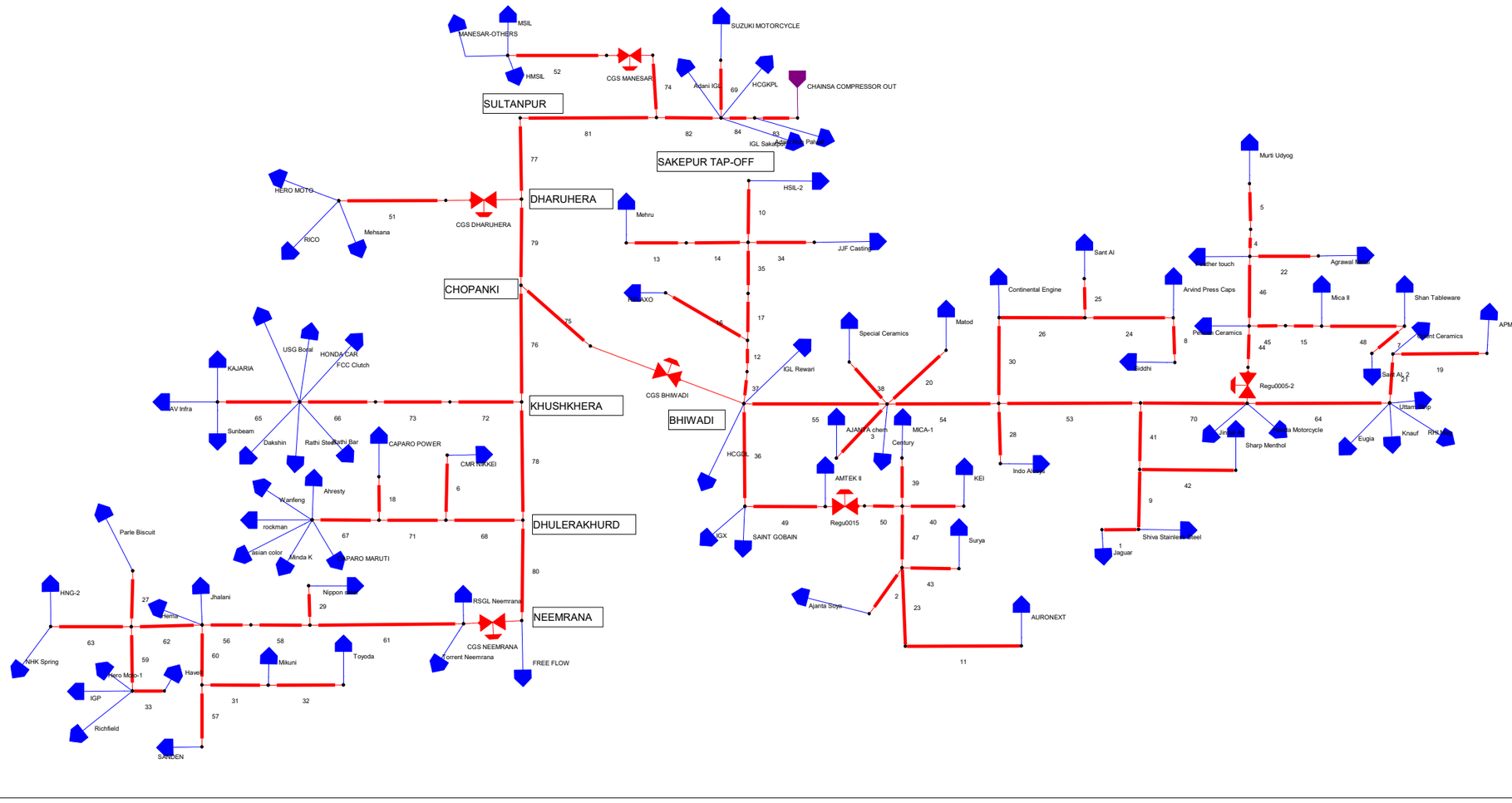
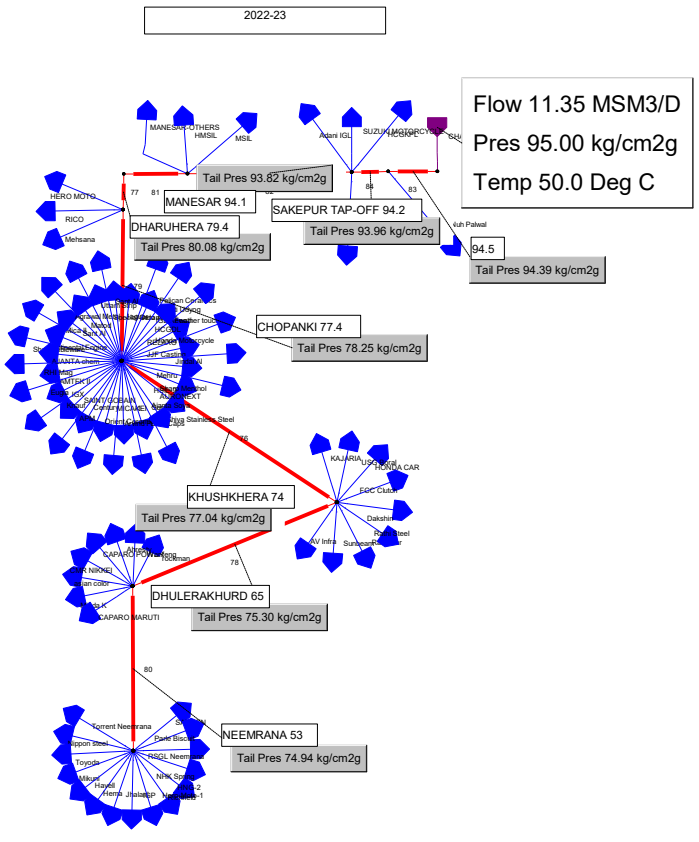


Pipe Section	Flow	Length	Dia
	MSM3/D	km	in
82	10.17	8.5	34.48
77	9.17	31.4	16.99
81	9.17	9.4	34.48
79	8.89	4.1	16.99
76	5.16	7.3	16.99
83	11.35	30	34.48
78	3.68	19.4	16.99
80	1.41	23.08	16.99
84	11.07	23.1	34.48


2022-23
Flow 11.35 MSM3/D
Pres 95.00 kg/cm2g
Temp 50.0 Deg C
Tail Pres 93.82 kg/cm2g
MANESAR 94.1
SAKEPUR TAP-OFF 94.2
Tail Pres 93.96 kg/cm2g
DHARUHERA 79.4
Tail Pres 80.08 kg/cm2g
94.5
Tail Pres 94.39 kg/cm2g
CHOPANKI 77.4
Tail Pres 78.25 kg/cm2g
KHUSHKHERA 74
Tail Pres 77.04 kg/cm2g
DHULERAKHURD 65
Tail Pres 75.30 kg/cm2g
NEEMRANA 53
Tail Pres 74.94 kg/cm2g

GAIL's views/inputs/comments on Draft Report on
Capacity Assessment of 05 Natural Gas Pipelines of GAIL shared by PNGRB

PNGRB, vide email dated 26.02.2024, has shared Draft Report for capacity assessment of following Natural Gas Pipelines of GAIL, soliciting GAIL's inputs on the same:

1. Narimanam-Kuthalam (NKM) sub-network of Cauvery Basin Natural Gas Pipeline Network
2. Chhainsa-Jhajjar-Hissar Natural Gas Pipeline (CJHPL)
3. Gujarat Natural Gas Pipeline Network
4. KG Basin Natural Gas Pipeline Network
5. GAIL Integrated Natural Gas Pipeline (GAIL INGPL)

In this regard, following are the comments / queries based on GAIL's understanding of the document:

A. Comments in general to all the networks assessments shared

I. For the purpose of reviewing the aforesaid draft reports, the respective TNet files are required so that the multiple assumptions of source/delivery/pipelines etc. can be viewed for clarity on assessment methodology. The request for sharing the TNet files has been submitted to PNGRB vide email dated 07.03.2024.

II. During the Capacity assessment exercise of 2011-12, the capacity determination was carried out by a Capacity Assessment Group (CAG) comprising of Prof. A Moharir of IIT Bombay, PNGRB representative and representatives of other entities owning and operating gas pipelines in the country (representatives of 02 transporters other than the entity of which the pipeline capacity is to be certified). The group ensured transparent approach to capacity assessment exercise through inclusion of practical and industrial aspects of determining capacity after discussion with the entities. It is understood that such constitution of Capacity Assessment Group, has not been done in the instant capacity assessment exercise.

III. It is pertinent to note that the capacity assessment group consisting of representatives from IIT Bombay, GSPL, GAIL, RGTIL as well as PNGRB, laid down various parameters to be considered for capacity assessment for natural gas pipeline networks. During capacity assessment of natural gas pipelines under the provision of regulations the duly constituted committee deliberated on various practical limitations and suggested following aspects for determination/finalization of natural gas pipeline networks capacity:
    1. All deliveries within 50 km of any source shall be limited to contractual flow quantities.
    2. Pressure drop across the metering and regulating stations taken as 4 barg or higher on the basis of documentary evidence.
    3. Pressure drop across check meter / station will be 2 barg.
    4. Following source capacity limitations to be considered:
        a. Depleting Source/Field: Source will be considered as a limiting source based on actual/current pressure and volume.

b. LNG terminal capacity: Terminal will be considered as a limiting source based on regasification capacity.
c. Contractual off-take: All source and customer contractual pressure volume requirement are to be considered
d. Entry point pressure limitations of source: All contractual obligations of pressure and offtake to be considered.

5. It was also considered that the farthest / most critical customer shall be considered for free flow (volume maximization). It was agreed that such method would give true capacity of the pipeline and all other customers on the network in this case would also be fulfilled in terms of their contractual requirements.

The committee further deliberated that these aspects shall be uniformly applicable in all the future capacity assessment of natural gas pipelines.

The points at point nos. III (1-4) above are referenced from the PNGRB order of 2016 on capacity of EWPL of M/s RGTIL. The document titled Order pertaining to capacity of Natural Gas East West Pipeline (EWPL) of M/s Reliance Gas Transportation Infrastructure Limited (RGTIL) for the period between 1.4.2010 to 31.03.2011 and 01.04.2011 to 31.03.2012 has been referenced. It is not clear whether the aforementioned parameters have been included in the capacity determination of subject networks or not.

IV. Further, CAG report of 2011 for RIL's EWPL, clause 1 (c)(b)(5) inter alia states that "At limiting condition of installed equipment (maximum available turbine power, compressor speed or maximum pressure, etc.) or delivery pressures, the maximum volumetric flow possible is considered as the capacity of the pipeline system that can be used for declaring system capacity. There was no data to suggest that other units such as filter, cooler, etc. were capacity limiting. In principle, any unit at such stations as represented in the station P&ID could be limiting and should be duly considered in capacity estimation". This implies that all limiting conditions of installed equipment viz. metering skids etc. must be considered in the capacity determination.
Since GAIL has not been provided the TNET files of the simulation, it is understood that the assessment of capacity of these networks has been carried out considering the equipment limitations at each of the tap-off locations as considered in previous assessments quoted herein. For instance, the installed pressure reduction skids at each of the branch lines along Sultanpur Neemrana section of CJHPL will pose limitations on account of their installed capacity.

V. Additionally, the CAG report of 2011 for RIL's EWPL, clause 1 (c)(b)(3) points out that pipeline efficiency can deteriorate with time with increase in surface roughness and may also vary across different sections. GAIL's experience with pipeline operations indicate that pipeline efficiencies range mostly between 85%-90% and the same vary across sections based on different diameters, pipeline roughness, coating and age difference factors, gas type etc. It is understood that same has been considered for the instant cases as the report does not mention the efficiency considered against each of the networks in the assessment.

The aforementioned assumptions of the previous CAG have been evolved based on detailed deliberations carried out between stakeholders, PNGRB and

their appointed representative from IIT Bombay. These deliberations acknowledged the various practical aspects of determination of pipeline capacity. Therefore, it is GAIL's request that these deliberations and recommendations of the last CAG may please be considered in the instant case as well.

VI. In the draft reports of capacity assessment clause 6.2 "Step wise methodology given for Capacity determination in Clause No. 5.(5) of PNGRB capacity regulation" at sub clause (ii) and (iii), it is mentioned that as per capacity regulation, at the originating point and at intermediate points in the direction of flow, the pressure should be set as a fixed parameter. It is requested to please provide the MAOP considered and the underlying philosophy in its selection thereof, in each of the cases and the individual sections. Further, it is understood that MAOP will be 4 kg/cm2 below the design pressure or the de-rated value as the case may be.

B. <u>Comments specific to the individual networks</u>:

Chhainsa-Jhajjar-Hissar NGPL (CJHPL):

VII. As per regulation 5 (5) (a) (iii) of the Capacity Determination Regulations, *" …. software will be run till any customer connected to the system reaches limiting condition of pressure required at the respective exit point or maximum flow capacity is reached at entry or intermediate compressor stations (if installed in the system) or the velocity of natural gas reaches limiting value…"*. In this regard, GAIL would like to emphasize that Chhainsa Compressor station is the feed compressor for CJHPL as well as for Dadri-Bawana-Nangal NG Pipeline (DBNPL) and Dadri-Panipat NG Pipeline (DPPL). Hence, total capacity of these networks will not exceed the capacity of Chhainsa compressor station. It may be noted that the rated capacity of Chhainsa compressor station is 53.5 MMSCMD.

VIII. It is requested to please provide the MAOP considered and the underlying philosophy in its selection thereof, in each of the cases and the individual sections. Further it is understood that MAOP will be 4 kg/cm2 below the design pressure or the de-rated value as the case may be.

Gujarat Regional, Cauvery Basin (NKM) and KG Basin Networks:

IX. Sub points (iii) and (iv) of clause 6.2 of the draft reports shared, may be read in conjunction with RIL order dated 30.12.2016 wherein it is emphasised that capacity assessment exercise for declared capacity goes by contractual obligations with regards to supply gas pressure. The networks of Gujarat, KG Basin and Cauvery Basin consist of depleting sources and there are contractual obligations on their offtake at pressures which are lower than the design pressure of the network they are connected to. It is requested to kindly confirm whether such contractual offtake requirements have been considered while assessment of capacity of these pipeline networks.

X. The RIL order dated 30.12.2016, add emphasis on the above. The order cites a case wherein, to maximise capacity of GSPL network, CAG had taken higher pressure at Atakpardi source of 93 barg instead of 85 barg HLPL pressure. By running the simulation with other nearby sources at higher pressure, simulated node pressure at HLPL came out to be 86 barg which was higher as against the maximum contractual available pressure at HLPL, thus automatically forcing flow from HLPL source as zero. Such case would mean that the contractual offtake of gas from sources will not be honoured.

XI. Further, the methodology adopted and elaborated at clause 6.2 of the draft reports mentions that gas at the entry point has been assumed as unlimited with MAOP conditions and then the selected software was run till any customer connected to the system reaches limiting condition as defined in regulation. In this regard, this, when read in conjunction with the aspects mentioned above at serial no. A(III), require that MAOP will be 4 kg/cm2 below the design pressure or the de-rated value as the case may be. It is requested to kindly confirm the MAOP considered for each section.

XII. In view of the above, it is requested to kindly confirm that the above-mentioned observations have been considered during the present capacity assessment. Further, it is again requested that TNet files may be provided for understanding the methodology of capacity assessment.

C. <u>Comments related to data</u>:

XIII. **MAOP data:**

a) **NKM Subnetwork of Cauvery Basin Network:** As per the data shared, the MAOP considered by EIL in the capacity assessment of NKM subnetwork of Cauvery Basin Network is 49 kg/cm2. In this regard, it is submitted that the NKM subnetwork is a closely interconnected network connected with multiple local gas fields. Though certain pipeline sections in this subnetwork have design pressure more than 19 kg/cm2, the entire subnetwork has MAOP of 19 kg/cm2.

b) Gujarat NGPL Subnetworks: A table showing the MAOP considered by EIL in the draft reports and the inputs of GAIL is provided below for kind consideration:

SN	Subnetwork	In EIL Report – MAOP (kg/cm2)	GAIL Inputs – MAOP (kg/cm2)	Remarks
1	Motwan,	19	5.5	
2	Kadi Kalol	19	49	
3	Mehsana	19	5.5	MRTS pipeline is non-existing and Sabar Dairy connectivity is customer pipeline.
4	Paliyad	19	5.5	
5	Kalol Ramol	49	4.5	

XIV. **Ex-Hazira Subnetwork data:** The requisite data in respect of determination of capacity of the Ex-Hazira subnetwork of Gujarat NGPL have been submitted to PNGRB vide email dated 05.03.2024.

XV. **Pipeline section details:** The length of KG Basin has been given as 796.97 km and that for NKM subnetwork of Cauvery Basin has been given as 245.33 km in the draft report. It is requested to kindly provide the sections considered for capacity determination.

XVI. **KG Basin pipeline replacement:** In the draft report it has been mentioned that Tatipaka -Oduru – KJ point section was changed in Assessment year 2017-18. Original & replacement sizes are both 18" respectively. Further, the length of replaced 24" pipeline section of Tatipaka – Chinchinad has been mentioned as 18.5 km. Both these data may please be reviewed in light of point no. 6.2.1.11 (d) (ii) under PNGRB's Ruling on actual capex at page 18 of the KG Basin Tariff Order dated 28.06.2019, a snapshot of the relevant table is provided below:

(Rs. Crore)

S. No.	Pipeline Sections	Original Size	Replaced size	Replaced Length (Km)	Capex Claimed	Capex considered
1	Tatipaka-Chinchinada	18"	24"	19.67	83.47	55.23
2	Tatipaka-Oduru-KJ Point	18"	24"	75.65	269.00	212.43
	Total			**95.32**	**352.47**	**267.66**

D. <u>Other comments related to Tariff submissions:</u>

XVII. **GAIL Integrated NG Pipeline:**

i) As mentioned in the Draft Capacity Assessment Report, "Tie-In Connectivity" from Natural Gas source of Jaya Fields (Jambusar, Gujarat) of M/s Vedanta Ltd. to South Gujarat Main sub-network of Gujarat Natural Gas Pipeline Network (GNGPN) of GAIL was not a part of Integrated pipeline network and South Gujarat Main sub-network as provided by entity. However, it is informed that while submission of Integrated NGPL Tariff to PNGRB, the Jambusar Tie-in connectivity with South Gujarat Sub-network with its expected commissioning date has been conveyed as Sep-2023 and the same was also considered by PNGRB in their Tariff Order.

ii) GAIL Integrated NGPL Capacity before and after commissioning of new source/Tie-in connectivities (additional capacity) may please be mentioned separately with respective dates in order to determine the Normative Volumes as per PNGRB Tariff Regulations.

iii) As per Draft Capacity Assesssment Report, Impact for Bokaro Tie-in connectivity and Jharia Tie-in connectivity has been considered in FY 2023-24. However, expected commissioning date of these Tie-in connectivity was August 2024 and same has been considered by PNGRB in the Tariff Order. Accordingly, the same may please be reviewed.

iv) At page no. 13 of the draft report, it is mentioned that Baroda, Kadi-Kalol, Kalol-Ramol, Mehsana, Motwan, Paliyad and Ex-Hazira sub-network are part of South Gujarat low pressure network and are shown as part of the sources of GAIL Integrated NGPL. The same may please be reviewed since the Baroda sub-network alone is part of the GAIL Integrated NGPL and other sub-networks are not a part of the same.

XVIII. **NKM Subnetwork of Cauvery Basin:**

The capacity of Cauvery Basin-NKM subnetwork before and after commissioning of the Madanam Tie-in connectivity may please be mentioned separately in the report for the purpose of calculation of Normative Volume as on respective commissioning dates as per PNGRB Tariff Regulations.

XIX. **CJHPL:**

Capacity of CJHPL before and after commissioning of the following may please be mentioned separately with respective dates in the report for the purpose of calculation of Normative Volume as per PNGRB Tariff Regulations:

i) Chhainsa Compressor Station
ii) Sultanpur-Jhajjar-Hissar section

XX. **Gujarat NGPL:**

i) Capex and Opex of certain customers (i.e. Schott Glass, HSGL, Haldyn Glass and Punjab Steel) of South Gujarat-Main were not considered by PNGRB while tariff processing of GAIL Integrated NGPL. Accordingly, the same needs to be specified separately in Capacity Assessment Report so that necessary treatment of Capex and Opex may be done in next tariff review by PNGRB.
ii) Capex and Opex of one another customer (i.e. Shyam Industries) under Kalol-Ramol sub-network also was not allowed in last tariff order. Accordingly, this section also needs to be specified separately in Capacity determination report for necessary treatment.

XXI. **KG Basin Network:**

i) Odalarevu Bodasakuru pipeline Tie-in connectivity was completed in Nov 2018, whereas, it has been mentioned in the draft Capacity Assessment Report that the Odalarevu source has been added in the year 2016-17.
ii) Bantumili Tie-in connectivity was completed in March-2023, and hence the impact of the same on the capacity of KG Basin Network may have to be determined.

*****

Email **ANSHU KUMAR**

Re: Capacity Assessment of the GAIL's CJHPL, KG BASIN & INTEGRATED NGPL networks

From : MRAGANG SHEAKHAR <m.sheakhar@eil.co.in> Thu, Mar 21, 2024 07:11 PM

Subject : Re: Capacity Assessment of the GAIL's CJHPL, KG BASIN & INTEGRATED NGPL networks 3 attachments

To : Technical Division PNGRB <e-technical.pngrb@nic.in>

Cc : JAYATI GHOSH <jayati.ghosh@eil.co.in>, HASMUKH K PARMAR <hk.parmar@eil.co.in>, ANSHU KUMAR <anshu.kumar@eil.co.in>, Anil Garg <garg.anil@pngrb.gov.in>, Muktikam Phukan <muktikamphukan@pngrb.gov.in>, Gagan Aggarwal <gaggarwal@pngrb.gov.in>, Yuvraj Singh Rathore <yuvraj.rathore@pngrb.gov.in>, Voona Venkata Narendra <narendra.vv@pngrb.gov.in>, VAIBHAV VAIBHAV <vaibhav.srivastava@eil.co.in>

Dear Sir,

With regard to Entity observations received vide trailing mail, no change is envisaged for capacity of subject networks and hence final study reports are attached for following :

- CHHAINSA-JHAJJAR-HISSAR NATURAL GAS PIPELINE (CJHPL)
- INTEGRATED/INTERCONNECTED PIPELINE NETWORK
- KG BASIN NGPL NETWORK

Annexures : https://email.gov.in/home...riefcase/PNGRB%2001032024
Regards,

Mragang Sheakhar | Process-1| Engineers India Limited, P&I Building, Gurgaon
Ground Floor, Icom 3025, Mobile 9555438664

From: "Technical Division PNGRB" <e-technical@pngrb.gov.in>
To: "JAYATI GHOSH" <jayati.ghosh@eil.co.in>
Cc: "HASMUKH K PARMAR" <hk.parmar@eil.co.in>, "MRAGANG SHEAKHAR" <m.sheakhar@eil.co.in>, "ANSHU KUMAR" <anshu.kumar@eil.co.in>, "Anil Garg" <garg.anil@pngrb.gov.in>, "Muktikam Phukan" <muktikamphukan@pngrb.gov.in>, "Gagan Aggarwal" <gaggarwal@pngrb.gov.in>, "Yuvraj Singh Rathore" <yuvraj.rathore@pngrb.gov.in>, "Voona Venkata

Narendra" <narendra.vv@pngrb.gov.in>
Sent: Tuesday, March 19, 2024 2:29:26 PM
Subject: Capacity Assessment of the GAIL's five NGPL networks

Dear Madam,

This has reference to updated reports on capacity assessment of the subject pipeline network and the meeting held on 26.02.2024 w.r.t review of the Capacity Assessment of the 06 Natural Gas Pipeline Networks.

As decided in the meeting the updated reports were shared with GAIL along with input/output files provided by EIL and GAIL was advised to submit its inputs on the updated report of the Capacity Assessment latest by 07.03.2024. Accordingly, GAIL has provided its inputs vide emails dated 07.03.2024, 18.03.2024 & 19.03.2024 which are enclosed as trailing mail(s).

In view of the above, EIL is hereby advised to review the inputs provided by GAIL and submit its reply to inputs of GAIL. Also, same may be annexed in the final report.

The Final report of the capacity assessment of five GAIL NGPL networks along with all Annexures shall be submitted to PNGRB by **22.03.2024** positively.

धन्यवाद और सादर | Thanks and Regards,

तकनीकी विभाग | Technical Division

पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड
Petroleum and Natural Gas Regulatory Board
प्रथम-तल, वर्ल्ड ट्रेड सेंटर, बाबर रोड, नई दिल्ली -११० ००१
1st Floor, World Trade Center, Babar Road, New Delhi - 110 001

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D: 011-23457741

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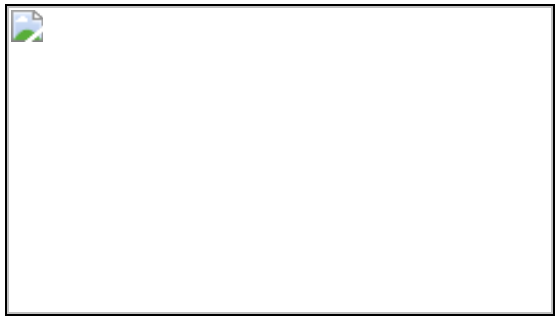
“कृपया पर्यावरण की रक्षा करें और इस ई-संदेश को केवल नितांत आवश्यक होने पर ही मुद्रित करें”



From: "Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप)" <cragroup@gail.co.in>
To: "Technical Division PNGRB" <e-technical.pngrb@nic.in>
Cc: "Secretary" <secretary@pngrb.gov.in>, "Anil Garg" <garg.anil@pngrb.gov.in>, "Gagan Aggarwal" <gaggarwal@pngrb.gov.in>, "Yuvraj Singh Rathore" <yuvraj.rathore@pngrb.gov.in>, "Voona Venkata Narendra" <narendra.vv@pngrb.gov.in>, skishore@gail.co.in, jpathak@gail.co.in, "r kannan" <r_kannan@gail.co.in>
Sent: Tuesday, March 19, 2024 10:30:58 AM
Subject: RE: Capacity Assessment of the GAIL's five NGPL networks

Dear Sir,

In continuation to the inputs/comments of GAIL as provided vide the trailing email, it is requested to kindly consider the following input also:

“In previous capacity assessment exercises by Capacity Assessment Group, an allowance of 5% was also considered for declared capacity as theoretical capacity are determined considering extreme conditions. Same may also be included in the present capacity assessment to maintain uniformity.”

Regards,

R Kannan,

DGM (Mktg-RA),

Regulatory Affairs Group,

GAIL (India) Limited, New Delhi

From: Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप)
Sent: 18 March 2024 17:47
To: 'Technical Division PNGRB' <e-technical.pngrb@nic.in>
Cc: R Kannan (आर. कन्नन) <r_kannan@gail.co.in>; Secretary <secretary@pngrb.gov.in>; Anil Garg <garg.anil@pngrb.gov.in>; Gagan Aggarwal <gaggarwal@pngrb.gov.in>; Yuvraj Singh Rathore <yuvraj.rathore@pngrb.gov.in>; Voona Venkata Narendra <narendra.vv@pngrb.gov.in>; Sumit Kishore (सुमित किशोर) <skishore@gail.co.in>; Jitendra Pathak (जितेन्द्र पाठक) <jpathak@gail.co.in>; R Kannan (आर. कन्नन) <r_kannan@gail.co.in>
Subject: RE: Capacity Assessment of the GAIL's five NGPL networks

Dear Sir,

With reference to the trailing email communications, and the meeting held at PNGRB on 14.03.2024, please find enclosed GAIL inputs/comments on the Draft Capacity Assessment Reports prepared by EIL for the following NG Pipelines of GAIL:

1. GAIL Integrated NGPL
2. Cauvery Basin Network – NKM subnetwork
3. Chhainsa Jhajjar Hissar NGPL
4. KG Basin Network
5. Gujarat NGPL subnetworks

Regards,

R Kannan,

DGM (Mktg-RA),

Regulatory Affairs Group,

GAIL (India) Limited, New Delhi

From: Technical Division PNGRB <e-technical@pngrb.gov.in>
Sent: 11 March 2024 14:34
To: Jitendra Pathak (जितेन्द्र पाठक) <jpathak@gail.co.in>; Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप) <cragroup@gail.co.in>
Cc: R Kannan (आर. कन्नन) <r_kannan@gail.co.in>; Secretary <secretary@pngrb.gov.in>; Anil Garg <garg.anil@pngrb.gov.in>; Gagan Aggarwal <gaggarwal@pngrb.gov.in>; Yuvraj Singh Rathore <yuvraj.rathore@pngrb.gov.in>; Voona Venkata Narendra <narendra.vv@pngrb.gov.in>
Subject: Re: Capacity Assessment of the GAIL's five NGPL networks

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This has reference to trailing mails(s).

We acknowledge the comments provided by GAIL.

As GAIL has not submitted any specific inputs to the EIL's Capacity Assessment draft reports for the five NGPL networks, we are going ahead with the reports for their finalization.

धन्यवाद और सादर | Thanks and Regards,

तकनीकी विभाग | Technical Division

पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड

Petroleum and Natural Gas Regulatory Board

प्रथम-तल, वर्ल्ड ट्रेड सेंटर, बाबर रोड, नई दिल्ली -११० ००१

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D: 011-23457741

From: "Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप)" <cragroup@gail.co.in>
To: "Technical Division PNGRB" <e-technical.pngrb@nic.in>
Cc: "Secretary" <secretary@pngrb.gov.in>, "Anil Garg" <garg.anil@pngrb.gov.in>, "Gagan Aggarwal" <gaggarwal@pngrb.gov.in>, "Yuvraj Singh Rathore" <yuvraj.rathore@pngrb.gov.in>, "Voona Venkata Narendra" <narendra.vv@pngrb.gov.in>, jpathak@gail.co.in, "r kannan" <r_kannan@gail.co.in>
Sent: Thursday, March 7, 2024 6:45:49 PM
Subject: RE: Capacity Assessment of the GAIL's five NGPL networks

Dear Sir,

With reference to the trailing emails on the subject, it is submitted that the draft Reports are being studied by concerned Departments in GAIL for providing inputs. Collating the inputs and subsequent approval needs sufficient time.

Further, it is observed that respective TNet files, based on which the draft reports have been prepared by EIL, are not available in the data folders shared by PNGRB. The TNet files are required to understand multiple assumptions of source/delivery/pipelines etc. to have better clarity on assessment methodology.

Hence, it is requested to kindly share the TNet files and allow us 2 more weeks for submitting the comments of GAIL on these draft reports.

Regards,

R Kannan,

DGM (Mktg-RA),

Regulatory Affairs Group,

GAIL (India) Limited, New Delhi

From: Technical Division PNGRB <e-technical@pngrb.gov.in>
Sent: 04 March 2024 15:20
To: Jitendra Pathak (जितेन्द्र पाठक) <jpathak@gail.co.in>; Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप) <cragroup@gail.co.in>
Cc: R Kannan (आर. कन्नन) <r_kannan@gail.co.in>; Secretary <secretary@pngrb.gov.in>; Anil Garg <garg.anil@pngrb.gov.in>; Gagan Aggarwal <gaggarwal@pngrb.gov.in>; Yuvraj Singh Rathore <yuvraj.rathore@pngrb.gov.in>; Voona Venkata Narendra <narendra.vv@pngrb.gov.in>
Subject: Re: Capacity Assessment of the GAIL's five NGPL networks

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Sir,

This is in furtherance to trailing mail(s). The input/output datasheet for capacity assessed for GAIL Gujarat Sub-Network by EIL is being forwarded for your perusal.

In line with the previous mail, you are advised to provide your inputs (as per Email dated 26.02.2024) latest by 07.03.2024 *for all the five NGPL networks*. In absence of any inputs by 07.03.2024, it will be presumed that you have no inputs w.r.t Capacity Assessment Report(s) of EIL and same may be considered as final report(s) towards capacity assessment.

धन्यवाद और सादर | Thanks and Regards,

तकनीकी विभाग | Technical Division

From: "Technical Division PNGRB" <e-technical@pngrb.gov.in>
To: "Jitendra Pathak (जितेन्द्र पाठक)" <jpathak@gail.co.in>, "Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप)" <cragroup@gail.co.in>
Cc: "R Kannan (आर. कन्नन)" <r_kannan@gail.co.in>, "Secretary" <secretary@pngrb.gov.in>, "Anil Garg" <garg.anil@pngrb.gov.in>, "Gagan Aggarwal" <gaggarwal@pngrb.gov.in>, "Yuvraj Singh Rathore" <yuvraj.rathore@pngrb.gov.in>, "Voona Venkata Narendra" <narendra.vv@pngrb.gov.in>
Sent: Saturday, March 2, 2024 3:46:20 PM
Subject: Re: Capacity Assessment of the GAIL's five NGPL networks

Sir,

This is in furtherance to trailing mail(s). The input/output datasheet for capacity assessed of EIL is being forwarded for your perusal.

You are advised to provide your inputs (as per Email dated 26.02.2024) latest by 07.03.2024 for following NGPL networks. In absence of any inputs by 07.03.2024, it will be presumed that you have no inputs w.r.t Capacity Assessment Report(s) of EIL and same may be considered as final report(s) towards capacity assessment. Please find enclosed datasheet for:

1. GAIL Integrated NGPL
2. Cauvery Basin Network
3. Chhainsa Jhajjar Hisar NGPL
4. KG Basin Network
5. Gujarat Sub-Network NGPL(will be share by Monday)

धन्यवाद और सादर | Thanks and Regards,

तकनीकी विभाग | Technical Division

पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड

Petroleum and Natural Gas Regulatory Board

प्रथम-तल, वर्ल्ड ट्रेड सेंटर, बाबर रोड, नई दिल्ली -११० ००१

1st Floor, World Trade Center, Babar Road, New Delhi - 110 001

From: "Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप)" <cragroup@gail.co.in>
To: "Technical Division PNGRB" <e-technical.pngrb@nic.in>
Cc: "Secretary" <secretary@pngrb.gov.in>, "Anil Garg" <garg.anil@pngrb.gov.in>, "Gagan Aggarwal" <gaggarwal@pngrb.gov.in>, "Yuvraj Singh Rathore" <yuvraj.rathore@pngrb.gov.in>, "Voona Venkata Narendra" <narendra.vv@pngrb.gov.in>, jpathak@gail.co.in, "r kannan" <r_kannan@gail.co.in>
Sent: Thursday, February 29, 2024 4:07:43 PM
Subject: RE: Capacity Assessment of the GAIL's five NGPL networks

Dear Sir,

Vide the trailing email and through One Drive, PNGRB has shared the DRAFT REPORTS of Capacity Assessment of the following five Natural Gas Pipeline networks of GAIL:

1. GAIL Integrated NGPL
2. Cauvery Basin Network
3. Chainsa – Jhajjar – Hissar NGPL
4. Gujarat NGPL sub networks
5. KG Basin Network

Studying these Draft Reports and the documents needs sufficient time. Hence, it is requested to kindly allow us one month time for providing the comments of GAIL on these draft reports.

Further, it is requested to kindly share the assumptions, if any, which might have been considered by EIL in the capacity determination in place of any unavailable data.

Regards,

R Kannan,

DGM (Mktg-RA),

Regulatory Affairs Group,

GAIL (India) Limited, New Delhi

From: Technical Division PNGRB <e-technical@pngrb.gov.in>
Sent: 26 February 2024 17:42
To: Jitendra Pathak (जितेन्द्र पाठक) <jpathak@gail.co.in>; Corporate Regulatory Affairs group (निगमित विनियामक मामला ग्रुप) <cragroup@gail.co.in>
Cc: R Kannan (आर. कन्नन) <r_kannan@gail.co.in>; Secretary <secretary@pngrb.gov.in>; Anil Garg <garg.anil@pngrb.gov.in>; Gagan Aggarwal <gaggarwal@pngrb.gov.in>; Yuvraj Singh Rathore <yuvraj.rathore@pngrb.gov.in>; Voona Venkata Narendra <narendra.vv@pngrb.gov.in>
Subject: Fwd: Capacity Assessment of the GAIL's five NGPL networks
Importance: High

CAUTION: External Email. Do not click links or open attachment unless you trust the Sender and know the Content is safe. Report suspicious mails to "cybersec@gail.co.in".

Sir,

Based on inputs from GAIL, EIL has submitted the reports of Capacity Assessment of five Natural Gas Pipeline networks (Copies enclosed and annexures of the reports have been shared through One Drive link).

You may like to see the same and offer your inputs on the following:

1. Verification of data/details considered by EIL in its assessments.
2. Difference between methodology adopted by EIL and GAIL, in line with the existing provisions of PNGRB (Determining Capacity of Petroleum, Petroleum Products and Natural Gas Pipeline) Regulations, 2010 for assessment of the capacity of

the respective NGPL networks.
You are advised to submit the same by 29.02.2024 positively.

धन्यवाद और सादर | Thanks and Regards,

तकनीकी विभाग | Technical Division

पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड

Petroleum and Natural Gas Regulatory Board

प्रथम-तल, वर्ल्ड ट्रेड सेंटर, बाबर रोड, नई दिल्ली -११० ००१

1st Floor, World Trade Center, Babar Road, New Delhi - 110 001

W: www.pngrb.gov.in

E: e-Technical@pngrb.gov.in

D: 011-23457741

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“कृपया पर्यावरण की रक्षा करें और इस ई-संदेश को केवल नितांत आवश्यक होने पर ही मुद्रित करें”

Har Ek Kaam Desh Ke Naam

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Report _GKGBNGL.pdf
643 KB

Report _GIIPN.pdf
485 KB

Report _CJHPL.pdf
646 KB
