



BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 1
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.1 hp	Compression Ratio	5.93	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	4.39	Volumetric Eff	74.0%
Percent Suct Vol Flow	82.5%	Ideal Volume Ratio	4.39	Adiabatic Eff	71.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	48.6	327.3	1737.7	7144.6	10.288
Discharge	245.0	352.0	327.3	382.4	7144.6	10.288

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	2111.2 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	97.9 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	64.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	33.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	245.0 °F	Molecular Weight	17.38
Upstream Pressure	48.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

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# TDSH 283L Open System



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Customer Name	Reference	Date 3/12/2008	Run # 1
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.1 hp	Compression Ratio	5.93	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	4.39	Volumetric Eff	74.0%
Percent Suct Vol Flow	82.5%	Ideal Volume Ratio	4.39	Adiabatic Eff	71.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	48.6	327.3	1737.7	7144.6	10.288
Discharge	245.0	352.0	327.3	382.4	7144.6	10.288

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	2111.2 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	97.9 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	64.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	33.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	245.0 °F	Molecular Weight	17.38
Upstream Pressure	48.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**COMPRESSOR**

<u>Bearings</u>			<u>Rotors</u>		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5029	79358	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	7608	98525	Balance Piston Force	12112.3 lbf	0.0 lbf
Female Inlet Radial	5613	82521	Inlet Blocking Dia	411 µin	533 µin
Female Outlet Radial	11593	36297	Outlet Blocking Dia	611 µin	858 µin
Male Axial	333	1000000	Max Rotor Body	1014 µin	1375 µin
Female Axial	3656	37915			
			Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.56	2.15

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.3 hp	Compression Ratio	5.10	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.82	Volumetric Eff	71.4%
Percent Suct Vol Flow	79.2%	Ideal Volume Ratio	3.82	Adiabatic Eff	72.3%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	58.6	367.1	1676.8	8015.2	11.542
Discharge	240.7	352.0	367.1	426.4	8015.2	11.542

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1963.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	96.0 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	63.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	32.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM**

Upstream Temperature	80.0 °F	Downstream Temperature	240.7 °F
Upstream Pressure	58.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

**FLUID**

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 2
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	5.10	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.82	Volumetric Eff	71.4%
Percent Suct Vol Flow	79.2%	Ideal Volume Ratio	3.82	Adiabatic Eff	72.3%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	58.6	367.1	1676.8	8015.2	11.542
Discharge	240.7	352.0	367.1	426.4	8015.2	11.542

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1963.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	96.0 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	63.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	32.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	240.7 °F
Upstream Pressure	58.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5052	78133	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	7731	93406	Balance Piston Force	11699.5 lbf	0.0 lbf
Female Inlet Radial	5638	81297	Inlet Blocking Dia	415 µin	537 µin
Female Outlet Radial	11678	35431	Outlet Blocking Dia	620 µin	865 µin
Male Axial	633	1000000	Max Rotor Body	1027 µin	1386 µin
Female Axial	3612	39309		Max allowable deflection 2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.53	2.14

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 3
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	4.48	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.38	Volumetric Eff	69.9%
Percent Suct Vol Flow	77.1%	Ideal Volume Ratio	3.38	Adiabatic Eff	73.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	68.6	409.2	1639.8	8934.5	12.866
Discharge	236.3	352.0	409.2	472.3	8934.5	12.866

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1815.6 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	94.1 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	62.5 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	31.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	236.3 °F
Upstream Pressure	68.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 3
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	4.48	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.38	Volumetric Eff	69.9%
Percent Suct Vol Flow	77.1%	Ideal Volume Ratio	3.38	Adiabatic Eff	73.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	68.6	409.2	1639.8	8934.5	12.866
Discharge	236.3	352.0	409.2	472.3	8934.5	12.866

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1815.6 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	94.1 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	62.5 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	31.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	236.3 °F
Upstream Pressure	68.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5078	76828	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	7835	89349	Balance Piston Force	11286.6 lbf	0.0 lbf
Female Inlet Radial	5676	79483	Inlet Blocking Dia	420 µin	542 µin
Female Outlet Radial	11758	34634	Outlet Blocking Dia	627 µin	872 µin
Male Axial	939	1000000	Max Rotor Body	1039 µin	1398 µin
Female Axial	3570	40737		Max allowable deflection 2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.50	2.12

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 4
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.3 hp	Compression Ratio	3.99	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.04	Volumetric Eff	69.0%
Percent Suct Vol Flow	75.9%	Ideal Volume Ratio	3.04	Adiabatic Eff	73.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	78.6	453.9	1619.9	9909.0	14.269
Discharge	231.8	352.0	453.9	520.5	9909.0	14.269

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1668.7 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	92.0 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	61.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	30.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	231.8 °F	Molecular Weight	17.38
Upstream Pressure	78.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 4
End User Name	Item	Atmospheric Pressure	12.90 psi
Project	Screw Open	Elevation	3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	3.99	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.04	Volumetric Eff	69.0%
Percent Suct Vol Flow	75.9%	Ideal Volume Ratio	3.04	Adiabatic Eff	73.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	78.6	453.9	1619.9	9909.0	14.269
Discharge	231.8	352.0	453.9	520.5	9909.0	14.269

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1668.7 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	92.0 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	61.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	30.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	231.8 °F
Upstream Pressure	78.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5231	69592	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8151	78303	Balance Piston Force	10873.8 lbf	0.0 lbf
Female Inlet Radial	5877	70776	Inlet Blocking Dia	435 µin	561 µin
Female Outlet Radial	12131	31208	Outlet Blocking Dia	652 µin	902 µin
Male Axial	1509	434682	Max Rotor Body	1080 µin	1449 µin
Female Axial	3577	40489	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.43	2.06

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item      Screw Open

Date 3/12/2008      Run # 5  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	3.60	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.77	Volumetric Eff	68.8%
Percent Suct Vol Flow	75.5%	Ideal Volume Ratio	2.77	Adiabatic Eff	74.4%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	88.6	501.8	1614.6	10955.8	15.776
Discharge	227.2	352.0	501.8	571.6	10955.8	15.776

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1521.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	89.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	60.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	29.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	227.2 °F
Upstream Pressure	88.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 5
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.3 hp	Compression Ratio	3.60	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.77	Volumetric Eff	68.8%
Percent Suct Vol Flow	75.5%	Ideal Volume Ratio	2.77	Adiabatic Eff	74.4%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	88.6	501.8	1614.6	10955.8	15.776
Discharge	227.2	352.0	501.8	571.6	10955.8	15.776

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1521.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	89.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	60.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	29.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	227.2 °F	Molecular Weight	17.38
Upstream Pressure	88.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**COMPRESSOR**

<u>Bearings</u>			<u>Rotors</u>		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5472	59886	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8612	65196	Balance Piston Force	10461.0 lbf	0.0 lbf
Female Inlet Radial	6194	59414	Inlet Blocking Dia	458 µin	592 µin
Female Outlet Radial	12704	26760	Outlet Blocking Dia	687 µin	948 µin
Male Axial	2260	129400	Max Rotor Body	1139 µin	1527 µin
Female Axial	3618	39116		Max allowable deflection 2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.32	1.97

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.4 hp	Compression Ratio	3.27	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.54	Volumetric Eff	69.0%
Percent Suct Vol Flow	75.6%	Ideal Volume Ratio	2.54	Adiabatic Eff	75.1%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	98.6	553.0	1619.6	12072.3	17.384
Discharge	222.5	352.0	553.0	625.6	12072.3	17.384

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1374.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	87.4 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	58.8 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	28.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	222.5 °F
Upstream Pressure	98.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## ERRORS AND WARNINGS

Disclaimer: the information contained in this program is subject to change without notice. Frick reserves the right to final verification of all rating results.



BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.4 hp	Compression Ratio	3.27	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.54	Volumetric Eff	69.0%
Percent Suct Vol Flow	75.6%	Ideal Volume Ratio	2.54	Adiabatic Eff	75.1%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	98.6	553.0	1619.6	12072.3	17.384
Discharge	222.5	352.0	553.0	625.6	12072.3	17.384

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1374.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	87.4 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	58.8 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	28.6 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	222.5 °F
Upstream Pressure	98.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5688	52614	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	9015	55975	Balance Piston Force	10048.2 lbf	0.0 lbf
Female Inlet Radial	6508	50377	Inlet Blocking Dia	480 µin	622 µin
Female Outlet Radial	13193	23593	Outlet Blocking Dia	720 µin	990 µin
Male Axial	2910	60635	Max Rotor Body	1194 µin	1601 µin
Female Axial	3640	38410	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.24	1.90

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.4 hp	Compression Ratio	3.00	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.35	Volumetric Eff	69.6%
Percent Suct Vol Flow	76.2%	Ideal Volume Ratio	2.35	Adiabatic Eff	75.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	108.6	607.9	1633.9	13271.3	19.111
Discharge	217.7	352.0	607.9	682.8	13271.3	19.111

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1228.9 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	84.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	57.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	27.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	217.7 °F	Molecular Weight	17.38
Upstream Pressure	108.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 7
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.4 hp	Compression Ratio	3.00	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.35	Volumetric Eff	69.6%
Percent Suct Vol Flow	76.2%	Ideal Volume Ratio	2.35	Adiabatic Eff	75.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	108.6	607.9	1633.9	13271.3	19.111
Discharge	217.7	352.0	607.9	682.8	13271.3	19.111

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1228.9 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	84.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	57.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	27.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	217.7 °F	Molecular Weight	17.38
Upstream Pressure	108.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**COMPRESSOR**

<u>Bearings</u>			<u>Rotors</u>	
Position	Load lbf	L10 (hrs)		
Male Inlet Radial	5616	54914	Rotor Thrust Direction	Normal
Male Outlet Radial	8833	59894	Balance Piston Force	9635.3 lbf
Female Inlet Radial	6563	48991	Inlet Blocking Dia	477 µin
Female Outlet Radial	12915	25327	Outlet Blocking Dia	712 µin
Male Axial	2801	67986	Max Rotor Body	1186 µin
Female Axial	3519	42537	Max allowable deflection	2140 µin
			Rotor Shaft Fatigue Safety Factor	2.27
				1.94

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 8
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.3 hp	Compression Ratio	2.77	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	71.1%
Percent Suct Vol Flow	77.5%	Ideal Volume Ratio	2.20	Adiabatic Eff	77.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	118.6	671.6	1667.7	14661.1	21.112
Discharge	212.4	352.0	671.6	748.4	14661.1	21.112

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1074.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	81.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	55.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	26.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	212.4 °F	Molecular Weight	17.38
Upstream Pressure	118.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.3 hp	Compression Ratio	2.77	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	71.1%
Percent Suct Vol Flow	77.5%	Ideal Volume Ratio	2.20	Adiabatic Eff	77.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	118.6	671.6	1667.7	14661.1	21.112
Discharge	212.4	352.0	671.6	748.4	14661.1	21.112

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1074.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	81.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	55.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	26.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

## FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	212.4 °F	Molecular Weight	17.38
Upstream Pressure	118.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## COMPRESSOR

### Bearings

### Rotors

Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5608	55155	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8656	64084	Balance Piston Force	9222.5 lbf	0.0 lbf
Female Inlet Radial	6691	45943	Inlet Blocking Dia	478 µin	632 µin
Female Outlet Radial	12754	26406	Outlet Blocking Dia	706 µin	981 µin
Male Axial	2833	65721	Max Rotor Body	1185 µin	1610 µin
Female Axial	3423	46194	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.31	1.96

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 9
End User Name	Item	Screw Open	Atmospheric Pressure 12.90 psi
Project		Elevation	3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.58	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	72.4%
Percent Suct Vol Flow	78.8%	Ideal Volume Ratio	2.06	Adiabatic Eff	77.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	128.6	736.0	1698.5	16067.3	23.137
Discharge	207.3	352.0	736.0	814.0	16067.3	23.137

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	932.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	78.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	53.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	25.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

### FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	207.3 °F	Molecular Weight	17.38
Upstream Pressure	128.6 psig	Downstream Pressure	352.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.58	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	72.4%
Percent Suct Vol Flow	78.8%	Ideal Volume Ratio	2.06	Adiabatic Eff	77.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	128.6	736.0	1698.5	16067.3	23.137
Discharge	207.3	352.0	736.0	814.0	16067.3	23.137

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	932.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	78.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	53.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	25.5 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	207.3 °F
Upstream Pressure	128.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5806	49145	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8952	57283	Balance Piston Force	8809.7 lbf	0.0 lbf
Female Inlet Radial	7041	38758	Inlet Blocking Dia	498 µin	662 µin
Female Outlet Radial	13124	24011	Outlet Blocking Dia	733 µin	1018 µin
Male Axial	3359	39435	Max Rotor Body	1234 µin	1680 µin
Female Axial	3421	46282	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.24	1.91

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.41	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	73.7%
Percent Suct Vol Flow	80.1%	Ideal Volume Ratio	1.94	Adiabatic Eff	77.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	138.6	802.0	1728.8	17509.1	25.213
Discharge	202.4	352.0	802.0	880.5	17509.1	25.213

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	799.4 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	75.6 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	51.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	24.4 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	202.4 °F
Upstream Pressure	138.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.41	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	73.7%
Percent Suct Vol Flow	80.1%	Ideal Volume Ratio	1.94	Adiabatic Eff	77.8%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	138.6	802.0	1728.8	17509.1	25.213
Discharge	202.4	352.0	802.0	880.5	17509.1	25.213

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	799.4 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	75.6 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	51.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	24.4 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	202.4 °F
Upstream Pressure	138.6 psig	Downstream Pressure	352.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

### Bearings

Position	Load lbf	L10 (hrs)
Male Inlet Radial	5947	45377
Male Outlet Radial	9185	52594
Female Inlet Radial	7314	34143
Female Outlet Radial	13384	22486
Male Axial	3847	26258
Female Axial	3415	46515

### Rotors

	Male	Female
Rotor Thrust Direction	Normal	Normal
Balance Piston Force	8396.9 lbf	0.0 lbf
Inlet Blocking Dia	513 µin	685 µin
Outlet Blocking Dia	754 µin	1046 µin
Max Rotor Body	1272 µin	1734 µin
Max allowable deflection		2140 µin
Rotor Shaft Fatigue Safety Factor	2.20	1.87

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item      Screw Open

Date 3/12/2008      Run # 1  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.1 hp	Compression Ratio	5.36	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	4.02	Volumetric Eff	84.8%
Percent Suct Vol Flow	93.3%	Ideal Volume Ratio	4.02	Adiabatic Eff	76.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	48.6	374.7	1989.8	8181.0	11.781
Discharge	244.0	317.0	374.7	483.6	8181.0	11.781

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1889.9 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	88.7 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	58.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	30.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	244.0 °F	Molecular Weight	17.38
Upstream Pressure	48.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

Disclaimer: the information contained in this program is subject to change without notice. Frick reserves the right to final verification of all rating results.



BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item

Screw Open

Date 3/12/2008

Atmospheric Pressure

Elevation

Run # 1

12.90 psi

3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	5.36	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	4.02	Volumetric Eff	84.8%
Percent Suct Vol Flow	93.3%	Ideal Volume Ratio	4.02	Adiabatic Eff	76.6%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	48.6	374.7	1989.8	8181.0	11.781
Discharge	244.0	317.0	374.7	483.6	8181.0	11.781

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1889.9 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	88.7 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	58.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	30.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	244.0 °F
Upstream Pressure	48.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors	
Position	Load lbf	L10 (hrs)	Male	Female
Male Inlet Radial	5282	67353	Rotor Thrust Direction	Normal
Male Outlet Radial	7761	92188	Balance Piston Force	10580.7 lbf
Female Inlet Radial	6253	57576	Inlet Blocking Dia	435 µin
Female Outlet Radial	11992	32431	Outlet Blocking Dia	636 µin
Male Axial	2008	184648	Max Rotor Body	1069 µin
Female Axial	3540	41765	Max allowable deflection	2140 µin
			Rotor Shaft Fatigue Safety Factor	2.51
				2.08

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008 Run # 2  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.0 hp	Compression Ratio	4.61	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.49	Volumetric Eff	81.7%
Percent Suct Vol Flow	89.5%	Ideal Volume Ratio	3.49	Adiabatic Eff	76.7%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	58.6	420.1	1918.7	9171.2	13.207
Discharge	239.0	317.0	420.1	538.3	9171.2	13.207

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1731.2 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	86.6 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	57.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	29.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

## FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	239.0 °F	Molecular Weight	17.38
Upstream Pressure	58.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

Run # 2

12.90 psi

3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.0 hp	Compression Ratio	4.61	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.49	Volumetric Eff	81.7%
Percent Suct Vol Flow	89.5%	Ideal Volume Ratio	3.49	Adiabatic Eff	76.7%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	58.6	420.1	1918.7	9171.2	13.207
Discharge	239.0	317.0	420.1	538.3	9171.2	13.207

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1731.2 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	86.6 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	57.3 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	29.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	239.0 °F
Upstream Pressure	58.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5271	67814	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	7862	88305	Balance Piston Force	10254.6 lbf	0.0 lbf
Female Inlet Radial	6225	58426	Inlet Blocking Dia	437 µin	583 µin
Female Outlet Radial	12007	32293	Outlet Blocking Dia	642 µin	912 µin
Male Axial	2134	153827	Max Rotor Body	1077 µin	1487 µin
Female Axial	3481	43924	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.49	2.08

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	4.05	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.09	Volumetric Eff	80.1%
Percent Suct Vol Flow	87.3%	Ideal Volume Ratio	3.09	Adiabatic Eff	77.1%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	68.6	469.2	1880.1	10243.7	14.751
Discharge	233.8	317.0	469.2	596.8	10243.7	14.751

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1571.3 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	84.3 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	56.0 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	28.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

## FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	233.8 °F	Molecular Weight	17.38
Upstream Pressure	68.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name	Reference	Date 3/12/2008	Run # 3
End User Name	Item	Atmospheric Pressure	12.90 psi
Project	Screw Open	Elevation	3577 ft

**COMPRESSOR - TDSH 283L**

Compressor Power	1460.1 hp	Compression Ratio	4.05	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	3.09	Volumetric Eff	80.1%
Percent Suct Vol Flow	87.3%	Ideal Volume Ratio	3.09	Adiabatic Eff	77.1%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	68.6	469.2	1880.1	10243.7	14.751
Discharge	233.8	317.0	469.2	596.8	10243.7	14.751

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1571.3 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	84.3 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	56.0 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	28.3 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	233.8 °F	Molecular Weight	17.38
Upstream Pressure	68.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**COMPRESSOR**

<u>Bearings</u>			<u>Rotors</u>	
Position	Load lbf	L10 (hrs)	Male	Female
Male Inlet Radial	5324	65601	Rotor Thrust Direction	Normal
Male Outlet Radial	7975	84220	Balance Piston Force	9841.7 lbf
Female Inlet Radial	6309	55895	Inlet Blocking Dia	444 µin
Female Outlet Radial	12108	31404	Outlet Blocking Dia	652 µin
Male Axial	2413	106310	Max Rotor Body	1096 µin
Female Axial	3434	45746	Max allowable deflection	2140 µin
			Rotor Shaft Fatigue Safety Factor	2.46
				2.07

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	3.61	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.78	Volumetric Eff	79.5%
Percent Suct Vol Flow	86.4%	Ideal Volume Ratio	2.78	Adiabatic Eff	77.7%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm) (MMSCFD)	
Suction	80.0	78.6	522.7	1865.7	11412.3	16.434
Discharge	228.4	317.0	522.7	659.8	11412.3	16.434

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1410.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	81.7 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	54.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	27.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	228.4 °F
Upstream Pressure	78.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	3.61	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.78	Volumetric Eff	79.5%
Percent Suct Vol Flow	86.4%	Ideal Volume Ratio	2.78	Adiabatic Eff	77.7%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	78.6	522.7	1865.7	11412.3	16.434
Discharge	228.4	317.0	522.7	659.8	11412.3	16.434

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1410.0 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	81.7 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	54.4 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	27.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	228.4 °F
Upstream Pressure	78.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

## FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5378	63454	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8040	81951	Balance Piston Force	9428.9 lbf	0.0 lbf
Female Inlet Radial	6459	51686	Inlet Blocking Dia	452 µin	605 µin
Female Outlet Radial	12173	30854	Outlet Blocking Dia	661 µin	936 µin
Male Axial	2669	78638	Max Rotor Body	1114 µin	1537 µin
Female Axial	3382	47919	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.44	2.06

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ftRun # 5  
12.90 psi  
3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.1 hp	Compression Ratio	3.25	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.53	Volumetric Eff	79.6%
Percent Suct Vol Flow	86.4%	Ideal Volume Ratio	2.53	Adiabatic Eff	78.3%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	88.6	580.5	1867.8	12674.0	18.251
Discharge	223.0	317.0	580.5	726.9	12674.0	18.251

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1249.8 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	78.9 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	52.7 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	26.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	223.0 °F	Molecular Weight	17.38
Upstream Pressure	88.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	3.25	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.53	Volumetric Eff	79.6%
Percent Suct Vol Flow	86.4%	Ideal Volume Ratio	2.53	Adiabatic Eff	78.3%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm) (MMSCFD)	
Suction	80.0	88.6	580.5	1867.8	12674.0	18.251
Discharge	223.0	317.0	580.5	726.9	12674.0	18.251

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1249.8 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	78.9 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	52.7 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	26.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

Upstream Temperature	80.0 °F	Downstream Temperature	223.0 °F
Upstream Pressure	88.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

### FLUID

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5412	62122	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8029	82342	Balance Piston Force	9016.1 lbf	0.0 lbf
Female Inlet Radial	6611	47824	Inlet Blocking Dia	457 µin	616 µin
Female Outlet Radial	12172	30859	Outlet Blocking Dia	665 µin	944 µin
Male Axial	2903	61098	Max Rotor Body	1125 µin	1559 µin
Female Axial	3326	50366	Max allowable deflection 2140 µin		
			Rotor Shaft Fatigue Safety Factor	2.44	2.06

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.2 hp	Compression Ratio	2.96	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.33	Volumetric Eff	80.4%
Percent Suct Vol Flow	87.0%	Ideal Volume Ratio	2.33	Adiabatic Eff	79.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	98.6	643.9	1885.9	14057.4	20.243
Discharge	217.3	317.0	643.9	799.5	14057.4	20.243

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1089.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	75.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	50.6 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	25.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	217.3 °F	Molecular Weight	17.38
Upstream Pressure	98.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008 Run # 6  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.2 hp	Compression Ratio	2.96	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.33	Volumetric Eff	80.4%
Percent Suct Vol Flow	87.0%	Ideal Volume Ratio	2.33	Adiabatic Eff	79.0%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	98.6	643.9	1885.9	14057.4	20.243
Discharge	217.3	317.0	643.9	799.5	14057.4	20.243

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	1089.5 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	75.8 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	50.6 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	25.2 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

## FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	217.3 °F	Molecular Weight	17.38
Upstream Pressure	98.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## COMPRESSOR

### Bearings

### Rotors

Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5491	59181	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8010	83001	Balance Piston Force	8603.3 lbf	0.0 lbf
Female Inlet Radial	6863	42212	Inlet Blocking Dia	464 µin	634 µin
Female Outlet Radial	12222	30442	Outlet Blocking Dia	670 µin	959 µin
Male Axial	3156	47529	Max Rotor Body	1141 µin	1595 µin
Female Axial	3270	52989	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.44	2.05

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.2 hp	Compression Ratio	2.72	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	81.8%
Percent Suct Vol Flow	88.4%	Ideal Volume Ratio	2.16	Adiabatic Eff	79.9%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	108.6	714.2	1919.5	15591.6	22.452
Discharge	211.3	317.0	714.2	879.0	15591.6	22.452

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	929.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	72.3 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	48.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	24.1 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM**

Upstream Temperature	80.0 °F	Downstream Temperature	211.3 °F
Upstream Pressure	108.6 psig	Downstream Pressure	317.0 psig
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi
		Separator Pres Drop	0.0 psi

**FLUID**

Molecular Weight	17.38
Cp/Cv	1.30
Compressibility Z	0.98
Molecular Weight	17.38

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

**TDSH 283L  
Open System**

CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
ProjectReference  
Item Screw OpenDate 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ftRun # 7  
12.90 psi  
3577 ft**COMPRESSOR - TDSH 283L**

Compressor Power	1460.2 hp	Compression Ratio	2.72	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	81.8%
Percent Suct Vol Flow	88.4%	Ideal Volume Ratio	2.16	Adiabatic Eff	79.9%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	108.6	714.2	1919.5	15591.6	22.452
Discharge	211.3	317.0	714.2	879.0	15591.6	22.452

**OIL SYSTEM**

Oil Type	CP-1516-100	Oil Cooler Heat Rej	929.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	72.3 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	48.2 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	24.1 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

**SYSTEM****FLUID**

Upstream Temperature	80.0 °F	Downstream Temperature	211.3 °F	Molecular Weight	17.38
Upstream Pressure	108.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

**COMPRESSOR**

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5551	57077	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	7972	84320	Balance Piston Force	8190.4 lbf	0.0 lbf
Female Inlet Radial	7094	37802	Inlet Blocking Dia	470 µin	650 µin
Female Outlet Radial	12241	30285	Outlet Blocking Dia	672 µin	971 µin
Male Axial	3476	35576	Max Rotor Body	1152 µin	1626 µin
Female Axial	3232	54902	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.45	2.05

**ERRORS AND WARNINGS**

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

Run # 8

12.90 psi

3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.51	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	83.1%
Percent Suct Vol Flow	89.6%	Ideal Volume Ratio	2.02	Adiabatic Eff	80.2%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	Standard Volume Flow (MMSCFD)
Suction	80.0	118.6	785.7	1951.2	17153.4	24.701
Discharge	205.7	317.0	785.7	958.9	17153.4	24.701

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	782.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	68.5 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	45.5 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	23.0 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

### SYSTEM

### FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	205.7 °F	Molecular Weight	17.38
Upstream Pressure	118.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## ERRORS AND WARNINGS

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BY JOHNSON CONTROLS

# TDSH 283L Open System



CoolWare v7.1.2

Registered To: Toromont Energy Systems - James Storoshenko

Customer Name  
End User Name  
Project

Reference  
Item Screw Open

Date 3/12/2008  
Atmospheric Pressure 12.90 psi  
Elevation 3577 ft

Run # 8  
12.90 psi  
3577 ft

## COMPRESSOR - TDSH 283L

Compressor Power	1460.1 hp	Compression Ratio	2.51	Eff Model	Hydrocarbon Mix
Speed	3550 rpm	Volume Ratio	2.20	Volumetric Eff	83.1%
Percent Suct Vol Flow	89.6%	Ideal Volume Ratio	2.02	Adiabatic Eff	80.2%
		Discharge Port	Standard		

	Temperature (°F)	Pressure (psig)	Mass Flow (lbm/min)	Volume Flow (cfm)	Standard Volume Flow (scfm)	(MMSCFD)
Suction	80.0	118.6	785.7	1951.2	17153.4	24.701
Discharge	205.7	317.0	785.7	958.9	17153.4	24.701

## OIL SYSTEM

Oil Type	CP-1516-100	Oil Cooler Heat Rej	782.1 kbtu/hr	Oil Pump Boost	0.0 psi
Oil Flow	68.5 gpm	Main Inj Oil Temp	160.0 °F	Oil System Pres Drop	10.0 psi
Main Inj Oil Flow	45.5 gpm	Bearing Oil Temp	160.0 °F	Main Inj Orifice Dia	0.469 in
Bearing Oil Flow	23.0 gpm	Oil Cooling	All Oil	Main Inj Cv	5.0
Oil Pump Piping	All Oil	Main Inj Valve Pos	100.0%	Main Inj Valve Dia	1.00 in

## SYSTEM

## FLUID

Upstream Temperature	80.0 °F	Downstream Temperature	205.7 °F	Molecular Weight	17.38
Upstream Pressure	118.6 psig	Downstream Pressure	317.0 psig	Cp/Cv	1.30
Suct Line Superheat	0.0 °F	Disc Line Desuperheat	0.0 °F	Compressibility Z	0.98
Suct Line Pres Drop	0.0 psi	Disc Line Pres Drop	0.0 psi	Molecular Weight	17.38
		Separator Pres Drop	0.0 psi		

## COMPRESSOR

Bearings			Rotors		
Position	Load lbf	L10 (hrs)		Male	Female
Male Inlet Radial	5671	53157	Rotor Thrust Direction	Normal	Normal
Male Outlet Radial	8097	80069	Balance Piston Force	7777.6 lbf	0.0 lbf
Female Inlet Radial	7381	33122	Inlet Blocking Dia	481 µin	671 µin
Female Outlet Radial	12402	28993	Outlet Blocking Dia	686 µin	992 µin
Male Axial	3871	25757	Max Rotor Body	1180 µin	1673 µin
Female Axial	3206	56248	Max allowable deflection	2140 µin	
			Rotor Shaft Fatigue Safety Factor	2.42	2.02

## ERRORS AND WARNINGS

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