Howden WLVi 321/220 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.000

Low Stages

Non Pumped Lube Circuit

Case A

1.013254 bar atmospheric — 0 Meters Elevation
14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	14.70	psia
	1.000	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	48.5	psia
	3.30	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00022
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	0.81	l/sec
Flow	1,080	kg/hr	Injection Line **(NP)**	2.32	l/sec
	300.0	g/sec	Total Pumped Oil Flow **(P)**	0.81	l/sec
Skid Volume		+/-5%			
Comp. Volume	6816	am3/hr	Total Oil Flow **(P+NP)**	3.13	l/sec
Absorbed Shaft Power	419.1	kW	Minimum Oil Pump	1.75	l/sec
Absorbed Shaft Torque	1127.2876	N.m	Oil Cooler Heat Rejection	312	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	104	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	90.08	%			
Isothermal Efficiency	54.66	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	80	°C
Bearings Oil Flow **(P)**	0.81	l/sec	Injection Line **(NP)**	2.32	l/sec
Oil Cooler Heat Rejection	179	kW			
			Total Oil Flow **(P+NP)**	3.1	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	12.8	usgpm
Flow	39.68	lb/min	Injection Line **(NP)**	36.8	usgpm
	2380.7	lb/hr	Total Pumped Oil Flow **(P)**	12.8	usgpm
Skid Volume		+/-5%			
Comp. Volume	4012	acfm	Total Oil Flow **(P+NP)**	49.6	usgpm
Absorbed Shaft Power	562.0	hp	Minimum Oil Pump	27.8	usgpm
Absorbed Shaft Torque	831	lb.ft	Oil Cooler Heat Rejection	17,764	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	218	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	176	°F
Bearings Oil Flow **(P)**	12.8	usgpm	Injection Line **(NP)**	36.8	us gpm
Oil Cooler Heat Rejection	10,188	Btu/min			
			Total Oil Flow **(P+NP)**	49.6	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/220 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case A

Inlet Flange Pressure	1.00	Atm
Outlet Flange Pressure	3.30	Atm

PART LOAD DATA

Rated Each Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
300.0	100	100.0	419.1
270.0	90	93.1	390.2
240.0	80	85.1	356.6
210.0	70	77.2	323.5
180.0	60	69.8	292.5
150.0	50	63.0	264.0
120.0	40	57.0	238.9
90.0	30	51.7	216.7
60.0	20	47.5	199.1
30.0	10	44.4	186.1

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/220 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.000

Low Stages

Non Pumped Lube Circuit

Case B

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	14.70	psia
	1.000	**Atm**
Inlet Temp	94.73	˚F
	34.85	˚C
Outlet Press.	70.5	psia
	4.80	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00022
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	1.03	l/sec
	1,038	kg/hr	Injection Line **(NP)**	3.52	l/sec
Flow	288.3	g/sec	Total Pumped Oil Flow **(P)**	1.03	l/sec
Skid Volume					
Comp. Volume	6551	am3/hr	Total Oil Flow **(P+NP)**	4.56	l/sec
Absorbed Shaft Power	562	kW	Minimum Oil Pump	2.21	l/sec
Absorbed Shaft Torque	1511	N.m	Oil Cooler Heat Rejection	459	kW
Oil/Gas dP	2.068	bar	Discharge Temperature	104	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	86.6	%			
Isothermal Efficiency	51.5	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	89	˚C
Bearings Oil Flow **(P)**	1.0	l/sec	Injection Line **(NP)**	3.52	l/sec
Oil Cooler Heat Rejection	286	kW			
			Total Oil Flow **(P+NP)**	4.6	l/sec

Full Load Performance (US Units)

Type	WLVi			Type	WLVi	
				Bearings Oil Flow **(P)**	16.4	usgpm
	38.1	lb/min		Injection Line **(NP)**	55.8	usgpm
Flow	2288	lb/hr	+/-5%	Total Pumped Oil Flow **(P)**	16.4	usgpm
Skid Volume						
Comp. Volume	3856	acfm		Total Oil Flow **(P+NP)**	72.2	usgpm
Absorbed Shaft Power	753.3	hp		Minimum Oil Pump	35.0	usgpm
Absorbed Shaft Torque	1114	lb.ft		Oil Cooler Heat Rejection	26,077	Btu/min
Bearings Oil/Gas dP	+30	psi		Discharge Temperature	219	˚F
Oil Supply Temperature	120.0	˚F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	193	˚F
Bearings Oil Flow **(P)**	16.37	usgpm	Injection Line **(NP)**	55.8	us gpm
Oil Cooler Heat Rejection	16,258	Btu/min			
			Total Oil Flow **(P+NP)**	72.2	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/220 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case B

Inlet Flange Pressure	1.00	Atm
Outlet Flange Pressure	4.80	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
288.3	100	100.0	561.8
259.5	90	93.9	527.5
230.6	80	87.0	488.7
201.8	70	80.2	450.5
173.0	60	73.9	415.1
144.2	50	68.0	382.0
115.3	40	62.9	353.3
86.5	30	58.4	328.1
57.7	20	54.9	308.4
28.8	10	52.3	293.8

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/220 28 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case C

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	15.43	psia
	1.050	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00052
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	1.21	l/sec
Flow	1,073	kg/hr	Injection Line (NP)	4.35	l/sec
	298.1	g/sec	Total Pumped Oil Flow (P)	1.21	l/sec
Skid Volume		+/-5%			
Comp. Volume	6456	am3/hr	Total Oil Flow (P+NP)	5.56	l/sec
Absorbed Shaft Power	686.5	kW	Minimum Oil Pump	2.21	l/sec
Absorbed Shaft Torque	1846.6952	N.m	Oil Cooler Heat Rejection	577	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	106	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	90.08	%			
Isothermal Efficiency	48.90	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	95	˚C
Bearings Oil Flow (P)	1.21	l/sec	Injection Line (NP)	4.35	l/sec
Oil Cooler Heat Rejection	376	kW			
			Total Oil Flow (P+NP)	5.6	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	19.2	usgpm
Flow	39.43	lb/min	Injection Line (NP)	69.0	usgpm
	2365.6	lb/hr	Total Pumped Oil Flow (P)	19.2	usgpm
Skid Volume		+/-5%			
Comp. Volume	3800	acfm	Total Oil Flow (P+NP)	88.2	usgpm
Absorbed Shaft Power	920.7	hp	Minimum Oil Pump	35.0	usgpm
Absorbed Shaft Torque	1362	lb.ft	Oil Cooler Heat Rejection	32,812	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	222	˚F
Oil Supply Temperature	120.0	˚F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	203	˚F
Bearings Oil Flow (P)	19.2	usgpm	Injection Line (NP)	69.0	us gpm
Oil Cooler Heat Rejection	21,389	Btu/min			
			Total Oil Flow (P+NP)	88.2	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- — Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- — Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

R1 Minimum Load values and torque are corrected

Howden WLVi 321/220 28 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case C

Inlet Flange Pressure	1.05	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
298.1	100	100.0	686.5
268.2	90	93.9	644.7
238.4	80	87.0	597.3
208.6	70	80.2	550.6
178.8	60	73.9	507.3
149.0	50	68.0	466.8
119.2	40	62.9	431.8
89.4	30	58.4	400.9
59.6	20	54.9	376.9
29.8	10	52.3	359.1

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/220 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case D

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	22.04	psia
	1.500	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	70.5	psia
	4.80	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00075
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	0.96	l/sec
Flow	1,619	kg/hr	Injection Line (NP)	2.95	l/sec
	449.6	g/sec	Total Pumped Oil Flow (P)	0.96	l/sec
Skid Volume		+/-5%			
Comp. Volume	6820	am3/hr	Total Oil Flow (P+NP)	3.91	l/sec
Absorbed Shaft Power	572.2	kW	Minimum Oil Pump	2.21	l/sec
Absorbed Shaft Torque	1539.263	N.m	Oil Cooler Heat Rejection	407	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	106	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	90.08	%			
Isothermal Efficiency	58.52	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	85	°C
Bearings Oil Flow (P)	0.96	l/sec	Injection Line (NP)	2.95	l/sec
Oil Cooler Heat Rejection	239	kW			
			Total Oil Flow (P+NP)	3.9	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	15.2	usgpm
	59.47	lb/min	Injection Line (NP)	46.8	usgpm
Flow	3568.4	lb/hr	Total Pumped Oil Flow (P)	15.2	usgpm
Skid Volume		+/-5%			
Comp. Volume	4014	acfm	Total Oil Flow (P+NP)	62.0	usgpm
Absorbed Shaft Power	767.4	hp	Minimum Oil Pump	35.0	usgpm
Absorbed Shaft Torque	1135	lb.ft	Oil Cooler Heat Rejection	23,119	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	222	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	185	°F
Bearings Oil Flow (P)	15.2	usgpm	Injection Line (NP)	46.8	us gpm
Oil Cooler Heat Rejection	13,567	Btu/min			
			Total Oil Flow (P+NP)	62.0	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/220 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case D

Inlet Flange Pressure	1.50	Atm
Outlet Flange Pressure	4.80	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
449.6	100	100.0	572.2
404.7	90	93.9	537.3
359.7	80	87.0	497.8
314.7	70	80.2	458.9
269.8	60	73.9	422.9
224.8	50	68.0	389.1
179.8	40	62.9	359.9
134.9	30	58.4	334.2
89.9	20	54.9	314.2
45.0	10	52.3	299.3

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/220 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case E

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	19.10	psia
	1.300	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00065
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	1.18	l/sec
Flow	1,330	kg/hr	Injection Line (NP)	4.31	l/sec
	369.5	g/sec	Total Pumped Oil Flow (P)	1.18	l/sec
Skid Volume		+/-5%			
Comp. Volume	6466	am3/hr	Total Oil Flow (P+NP)	5.49	l/sec
Absorbed Shaft Power	707.2	kW	Minimum Oil Pump	2.21	l/sec
Absorbed Shaft Torque	1902.3391	N.m	Oil Cooler Heat Rejection	571	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	106	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	90.08	%			
Isothermal Efficiency	51.72	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	94	°C
Bearings Oil Flow (P)	1.18	l/sec	Injection Line (NP)	4.31	l/sec
Oil Cooler Heat Rejection	356	kW			
			Total Oil Flow (P+NP)	5.5	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	18.7	usgpm
Flow	48.87	lb/min	Injection Line (NP)	68.3	usgpm
	2932.5	lb/hr	Total Pumped Oil Flow (P)	18.7	usgpm
Skid Volume		+/-5%			
Comp. Volume	3806	acfm	Total Oil Flow (P+NP)	87.0	usgpm
Absorbed Shaft Power	948.4	hp	Minimum Oil Pump	35.0	usgpm
Absorbed Shaft Torque	1403	lb.ft	Oil Cooler Heat Rejection	32,471	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	223	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	200	°F
Bearings Oil Flow (P)	18.7	usgpm	Injection Line (NP)	68.3	us gpm
Oil Cooler Heat Rejection	20,246	Btu/min			
			Total Oil Flow (P+NP)	87.0	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/220 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case E

Inlet Flange Pressure	1.30	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
369.5	100	100.0	707.2
332.5	90	93.9	664.1
295.6	80	87.0	615.3
258.6	70	80.2	567.2
221.7	60	73.9	522.6
184.7	50	68.0	480.9
147.8	40	62.9	444.8
110.8	30	58.4	413.0
73.9	20	54.9	388.3
36.9	10	52.3	369.9

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case A

1.013254 bar atmospheric — 0 Meters Elevation
14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	14.70	psia
	1.000	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	48.5	psia
	3.30	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.0005
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	0.81	l/sec
	883	kg/hr	Injection Line **(NP)**	2.86	l/sec
Flow	245.2	g/sec	Total Pumped Oil Flow **(P)**	0.81	l/sec
Skid Volume		+/-5%			
Comp. Volume	5577	am3/hr	Total Oil Flow **(P+NP)**	3.67	l/sec
Absorbed Shaft Power	374.0	kW	Minimum Oil Pump	1.46	l/sec
Absorbed Shaft Torque	1005.9337	N.m	Oil Cooler Heat Rejection	299	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	94	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	87.33	%			
Isothermal Efficiency	50.11	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	73	°C
Bearings Oil Flow **(P)**	0.81	l/sec	Injection Line **(NP)**	2.86	l/sec
Oil Cooler Heat Rejection	161	kW			
			Total Oil Flow **(P+NP)**	3.7	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	12.8	usgpm
	32.43	lb/min	Injection Line **(NP)**	45.3	usgpm
Flow	1946.1	lb/hr	Total Pumped Oil Flow **(P)**	12.8	usgpm
Skid Volume		+/-5%			
Comp. Volume	3282	acfm	Total Oil Flow **(P+NP)**	58.1	usgpm
Absorbed Shaft Power	501.5	hp	Minimum Oil Pump	23.1	usgpm
Absorbed Shaft Torque	742	lb.ft	Oil Cooler Heat Rejection	17,019	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	201	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	163	°F
Bearings Oil Flow **(P)**	12.8	usgpm	Injection Line **(NP)**	45.3	us gpm
Oil Cooler Heat Rejection	9,173	Btu/min			
			Total Oil Flow **(P+NP)**	58.1	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case A

Inlet Flange Pressure	1.00	Atm
Outlet Flange Pressure	3.30	Atm

PART LOAD DATA

Rated Each Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
245.2	100	100.0	374.0
220.7	90	93.1	348.2
196.2	80	85.1	318.2
171.6	70	77.2	288.7
147.1	60	69.8	261.0
122.6	50	63.0	235.6
98.1	40	57.0	213.2
73.6	30	51.7	193.3
49.0	20	47.5	177.6
24.5	10	44.4	166.0

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/193 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case B

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	14.70	psia
	1.000	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	70.5	psia
	4.80	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.0005
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	1.03	l/sec
Flow	870	kg/hr	Injection Line **(NP)**	3.52	l/sec
	241.6	g/sec	Total Pumped Oil Flow **(P)**	1.03	l/sec
Skid Volume					
Comp. Volume	5493	am3/hr	Total Oil Flow **(P+NP)**	4.56	l/sec
Absorbed Shaft Power	486	kW	Minimum Oil Pump	1.75	l/sec
Absorbed Shaft Torque	1308	N.m	Oil Cooler Heat Rejection	408	kW
Oil/Gas dP	2.068	bar	Discharge Temperature	98	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	72.6	%			
Isothermal Efficiency	49.9	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	79	°C
Bearings Oil Flow **(P)**	1.0	l/sec	Injection Line **(NP)**	3.52	l/sec
Oil Cooler Heat Rejection	249	kW			
			Total Oil Flow **(P+NP)**	4.6	l/sec

Full Load Performance (US Units)

Type	WLVi			Type	WLVi	
				Bearings Oil Flow **(P)**	16.4	usgpm
Flow	32.0	lb/min	+/-5%	Injection Line **(NP)**	55.8	usgpm
	1917	lb/hr		Total Pumped Oil Flow **(P)**	16.4	usgpm
Skid Volume						
Comp. Volume	3233	acfm		Total Oil Flow **(P+NP)**	72.2	usgpm
Absorbed Shaft Power	652.2	hp		Minimum Oil Pump	27.8	usgpm
Absorbed Shaft Torque	965	lb.ft		Oil Cooler Heat Rejection	23,167	Btu/min
Bearings Oil/Gas dP	+30	psi		Discharge Temperature	208	°F
Oil Supply Temperature	120.0	°F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	174	°F
Bearings Oil Flow **(P)**	16.40	usgpm	Injection Line **(NP)**	55.8	us gpm
Oil Cooler Heat Rejection	14,161	Btu/min			
			Total Oil Flow **(P+NP)**	72.2	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/193 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case B

Inlet Flange Pressure	1.00	Atm
Outlet Flange Pressure	4.80	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
241.6	100	100.0	486.3
217.4	90	93.9	456.7
193.3	80	87.0	423.1
169.1	70	80.2	390.0
144.9	60	73.9	359.4
120.8	50	68.0	330.7
96.6	40	62.9	305.9
72.5	30	58.4	284.0
48.3	20	54.9	267.0
24.2	10	52.3	254.4

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/193 28 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case C

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	15.43	psia
	1.050	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00052
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	1.21	l/sec
Flow	895	kg/hr	Injection Line (NP)	4.04	l/sec
	248.7	g/sec	Total Pumped Oil Flow (P)	1.21	l/sec
Skid Volume		+/-5%			
Comp. Volume	5387	am3/hr	Total Oil Flow (P+NP)	5.25	l/sec
Absorbed Shaft Power	590.7	kW	Minimum Oil Pump	1.99	l/sec
Absorbed Shaft Torque	1588.974	N.m	Oil Cooler Heat Rejection	505	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	102	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	8733.14	%			
Isothermal Efficiency	47.42	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	83	˚C
Bearings Oil Flow (P)	1.21	l/sec	Injection Line (NP)	4.04	l/sec
Oil Cooler Heat Rejection	326	kW			
			Total Oil Flow (P+NP)	5.2	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	19.2	usgpm
	32.90	lb/min	Injection Line (NP)	64.0	usgpm
Flow	1973.8	lb/hr	Total Pumped Oil Flow (P)	19.2	usgpm
Skid Volume		+/-5%			
Comp. Volume	3171	acfm	Total Oil Flow (P+NP)	83.2	usgpm
Absorbed Shaft Power	792.2	hp	Minimum Oil Pump	31.6	usgpm
Absorbed Shaft Torque	1172	lb.ft	Oil Cooler Heat Rejection	28,700	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	215	˚F
Oil Supply Temperature	120.0	˚F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	181	˚F
Bearings Oil Flow (P)	19.2	usgpm	Injection Line (NP)	64.0	us gpm
Oil Cooler Heat Rejection	18,506	Btu/min			
			Total Oil Flow (P+NP)	83.2	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- — Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- — Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/193 28 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case C

Inlet Flange Pressure	1.05	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
248.7	100	100.0	590.7
223.8	90	93.9	554.7
199.0	80	87.0	513.9
174.1	70	80.2	473.8
149.2	60	73.9	436.5
124.3	50	68.0	401.7
99.5	40	62.9	371.6
74.6	30	58.4	345.0
49.7	20	54.9	324.3
24.9	10	52.3	308.9

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case D

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	22.04	psia
	1.500	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	70.5	psia
	4.80	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00075
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	0.96	l/sec
Flow	1,324	kg/hr	Injection Line (NP)	3.31	l/sec
	367.9	g/sec	Total Pumped Oil Flow (P)	0.96	l/sec
Skid Volume		+/-5%			
Comp. Volume	5580	am3/hr	Total Oil Flow (P+NP)	4.26	l/sec
Absorbed Shaft Power	500.9	kW	Minimum Oil Pump	1.65	l/sec
Absorbed Shaft Torque	1347.3293	N.m	Oil Cooler Heat Rejection	381	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	98	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	8733.14	%			
Isothermal Efficiency	54.70	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	76	°C
Bearings Oil Flow (P)	0.96	l/sec	Injection Line (NP)	3.31	l/sec
Oil Cooler Heat Rejection	211	kW			
			Total Oil Flow (P+NP)	4.3	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	15.2	usgpm
Flow	48.66	lb/min	Injection Line (NP)	52.4	usgpm
	2919.6	lb/hr	Total Pumped Oil Flow (P)	15.2	usgpm
Skid Volume		+/-5%			
Comp. Volume	3284	acfm	Total Oil Flow (P+NP)	67.6	usgpm
Absorbed Shaft Power	671.7	hp	Minimum Oil Pump	26.2	usgpm
Absorbed Shaft Torque	994	lb.ft	Oil Cooler Heat Rejection	21,649	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	208	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	169	°F
Bearings Oil Flow (P)	15.2	usgpm	Injection Line (NP)	52.4	us gpm
Oil Cooler Heat Rejection	12,008	Btu/min			
			Total Oil Flow (P+NP)	67.6	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case D

Inlet Flange Pressure	1.50	Atm
Outlet Flange Pressure	4.80	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
367.9	100	100.0	500.9
331.1	90	93.9	470.3
294.3	80	87.0	435.8
257.5	70	80.2	401.7
220.7	60	73.9	370.2
183.9	50	68.0	340.6
147.1	40	62.9	315.1
110.4	30	58.4	292.5
73.6	20	54.9	275.0
36.8	10	52.3	262.0

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/193 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Low Stages

Non Pumped Lube Circuit

Case E

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	19.10	psia
	1.300	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00065
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	1.18	l/sec
Flow	1,118	kg/hr	Injection Line (NP)	3.93	l/sec
	310.6	g/sec	Total Pumped Oil Flow (P)	1.18	l/sec
Skid Volume		+/-5%			
Comp. Volume	5436	am3/hr	Total Oil Flow (P+NP)	5.11	l/sec
Absorbed Shaft Power	612.6	kW	Minimum Oil Pump	1.94	l/sec
Absorbed Shaft Torque	1647.8658	N.m	Oil Cooler Heat Rejection	503	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	103	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	8733.14	%			
Isothermal Efficiency	50.20	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	82	˚C
Bearings Oil Flow (P)	1.18	l/sec	Injection Line (NP)	3.93	l/sec
Oil Cooler Heat Rejection	311	kW			
			Total Oil Flow (P+NP)	5.1	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	18.7	usgpm
Flow	41.09	lb/min	Injection Line (NP)	62.3	usgpm
	2465.4	lb/hr	Total Pumped Oil Flow (P)	18.7	usgpm
Skid Volume		+/-5%			
Comp. Volume	3200	acfm	Total Oil Flow (P+NP)	81.0	usgpm
Absorbed Shaft Power	821.5	hp	Minimum Oil Pump	30.8	usgpm
Absorbed Shaft Torque	1215	lb.ft	Oil Cooler Heat Rejection	28,606	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	217	˚F
Oil Supply Temperature	120.0	˚F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	180	˚F
Bearings Oil Flow (P)	18.7	usgpm	Injection Line (NP)	62.3	us gpm
Oil Cooler Heat Rejection	17,659	Btu/min			
			Total Oil Flow (P+NP)	81.0	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- — Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- — Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a pumped 1.93 L/D rate at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/193 26 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case E

Inlet Flange Pressure	1.30	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
310.6	100	100.0	612.6
279.6	90	93.9	575.2
248.5	80	87.0	533.0
217.4	70	80.2	491.3
186.4	60	73.9	452.7
155.3	50	68.0	416.6
124.3	40	62.9	385.3
93.2	30	58.4	357.8
62.1	20	54.9	336.3
31.1	10	52.3	320.4

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Medium Stages

Non Pumped Lube Circuit

Case A

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	16.17	psia
	1.100	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	48.5	psia
	3.30	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00055
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	0.79	l/sec
Flow	866	kg/hr	Injection Line **(NP)**	2.42	l/sec
	240.5	g/sec	Total Pumped Oil Flow **(P)**	0.79	l/sec
Skid Volume		+/-5%			
Comp. Volume	4971	am3/hr	Total Oil Flow **(P+NP)**	3.20	l/sec
Absorbed Shaft Power	332.1	kW	Minimum Oil Pump	1.44	l/sec
Absorbed Shaft Torque	893.2049	N.m	Oil Cooler Heat Rejection	259	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	93	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	87.58	%			
Isothermal Efficiency	50.92	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	72	°C
Bearings Oil Flow **(P)**	0.79	l/sec	Injection Line **(NP)**	2.42	l/sec
Oil Cooler Heat Rejection	136	kW			
			Total Oil Flow **(P+NP)**	3.2	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	12.5	usgpm
Flow	31.81	lb/min	Injection Line **(NP)**	38.3	usgpm
	1908.8	lb/hr	Total Pumped Oil Flow **(P)**	12.5	usgpm
Skid Volume		+/-5%			
Comp. Volume	2926	acfm	Total Oil Flow **(P+NP)**	50.8	usgpm
Absorbed Shaft Power	445.3	hp	Minimum Oil Pump	22.8	usgpm
Absorbed Shaft Torque	659	lb.ft	Oil Cooler Heat Rejection	14,745	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	200	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	162	°F
Bearings Oil Flow **(P)**	12.5	usgpm	Injection Line **(NP)**	38.3	us gpm
Oil Cooler Heat Rejection	7,729	Btu/min			
			Total Oil Flow **(P+NP)**	50.8	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case A

Inlet Flange Pressure	1.10	Atm
Outlet Flange Pressure	3.30	Atm

PART LOAD DATA

Rated Each Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
240.5	100	100.0	332.1
216.5	90	92.9	308.5
192.4	80	84.6	280.9
168.4	70	76.5	254.0
144.3	60	68.8	228.5
120.3	50	61.8	205.2
96.2	40	55.5	184.3
72.2	30	50.0	166.0
48.1	20	45.6	151.4
24.1	10	42.3	140.5

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Medium Stages

Non Pumped Lube Circuit

Case B

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	29.39	psia
	2.000	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	70.5	psia
	4.80	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.001
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow **(P)**	0.88	l/sec
Flow	1,580	kg/hr	Injection Line **(NP)**	2.64	l/sec
	438.9	g/sec	Total Pumped Oil Flow **(P)**	0.88	l/sec
Skid Volume					
Comp. Volume	4994	am3/hr	Total Oil Flow **(P+NP)**	3.53	l/sec
Absorbed Shaft Power	440	kW	Minimum Oil Pump	1.56	l/sec
Absorbed Shaft Torque	1407	N.m	Oil Cooler Heat Rejection	301	kW
Oil/Gas dP	2.068	bar	Discharge Temperature	96	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	88.0	%			
Isothermal Efficiency	55.9	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	73	˚C
Bearings Oil Flow **(P)**	0.9	l/sec	Injection Line **(NP)**	2.64	l/sec
Oil Cooler Heat Rejection	157	kW			
			Total Oil Flow **(P+NP)**	3.5	l/sec

Full Load Performance (US Units)

Type	WLVi			Type	WLVi	
				Bearings Oil Flow **(P)**	14.0	usgpm
	58.1	lb/min	+/-5%	Injection Line **(NP)**	41.9	usgpm
Flow	3484	lb/hr		Total Pumped Oil Flow **(P)**	14.0	usgpm
Skid Volume						
Comp. Volume	2939	acfm		Total Oil Flow **(P+NP)**	55.9	usgpm
Absorbed Shaft Power	590.0	hp		Minimum Oil Pump	24.7	usgpm
Absorbed Shaft Torque	1038	lb.ft		Oil Cooler Heat Rejection	17,133	Btu/min
Bearings Oil/Gas dP	+30	psi		Discharge Temperature	204	˚F
Oil Supply Temperature	120.0	˚F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	164	˚F
Bearings Oil Flow **(P)**	14.00	usgpm	Injection Line **(NP)**	41.9	us gpm
Oil Cooler Heat Rejection	8,915	Btu/min			
			Total Oil Flow **(P+NP)**	55.9	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case B

Inlet Flange Pressure	2.00	Atm
Outlet Flange Pressure	4.80	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
438.9	100	100.0	440.0
395.0	90	92.6	407.4
351.1	80	83.7	368.2
307.2	70	75.0	330.0
263.4	60	66.7	293.5
219.5	50	59.0	259.6
175.6	40	52.1	229.2
131.7	30	46.1	202.8
87.8	20	41.3	181.7
43.9	10	37.6	165.4

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Medium Stages

Non Pumped Lube Circuit

Case C

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	37.47	psia
	2.550	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00127
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	1.00	l/sec
Flow	1,992	kg/hr	Injection Line (NP)	2.92	l/sec
	553.2	g/sec	Total Pumped Oil Flow (P)	1.00	l/sec
Skid Volume		+/-5%			
Comp. Volume	4938	am3/hr	Total Oil Flow (P+NP)	3.92	l/sec
Absorbed Shaft Power	554.2	kW	Minimum Oil Pump	1.70	l/sec
Absorbed Shaft Torque	1490.7877	N.m	Oil Cooler Heat Rejection	367	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	100	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	87.58	%			
Isothermal Efficiency	55.78	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	76	°C
Bearings Oil Flow (P)	1.00	l/sec	Injection Line (NP)	2.92	l/sec
Oil Cooler Heat Rejection	196	kW			
			Total Oil Flow (P+NP)	3.9	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	15.8	usgpm
Flow	73.18	lb/min	Injection Line (NP)	46.3	usgpm
	4390.6	lb/hr	Total Pumped Oil Flow (P)	15.8	usgpm
Skid Volume		+/-5%			
Comp. Volume	2907	acfm	Total Oil Flow (P+NP)	62.1	usgpm
Absorbed Shaft Power	743.2	hp	Minimum Oil Pump	27.0	usgpm
Absorbed Shaft Torque	1100	lb.ft	Oil Cooler Heat Rejection	20,843	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	212	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	169	°F
Bearings Oil Flow (P)	15.8	usgpm	Injection Line (NP)	46.3	us gpm
Oil Cooler Heat Rejection	11,148	Btu/min			
			Total Oil Flow (P+NP)	62.1	usgpm

(P) = Pumped Oil (NP) = Non Pumped Oil
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case C

Inlet Flange Pressure	2.55	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
553.2	100	100.0	554.2
497.9	90	92.6	513.2
442.6	80	83.7	463.9
387.2	70	74.9	415.1
331.9	60	66.6	369.1
276.6	50	59.0	327.0
221.3	40	52.1	288.7
166.0	30	46.1	255.5
110.6	20	41.2	228.3
55.3	10	37.5	207.8

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

Medium Stages

Non Pumped Lube Circuit

Case D

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	41.88	psia
	2.850	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00142
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	0.95	l/sec
Flow	2,229	kg/hr	Injection Line (NP)	2.81	l/sec
	619.2	g/sec	Total Pumped Oil Flow (P)	0.95	l/sec
Skid Volume		+/-5%			
Comp. Volume	4946	am3/hr	Total Oil Flow (P+NP)	3.77	l/sec
Absorbed Shaft Power	549.7	kW	Minimum Oil Pump	1.65	l/sec
Absorbed Shaft Torque	1478.5921	N.m	Oil Cooler Heat Rejection	344	kW
Oil/Gas dP	2.0684277	bar	Discharge Temperature	99	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	87.58	%			
Isothermal Efficiency	54.92	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	75	°C
Bearings Oil Flow (P)	0.95	l/sec	Injection Line (NP)	2.81	l/sec
Oil Cooler Heat Rejection	181	kW			
			Total Oil Flow (P+NP)	3.8	l/sec

Full Load Performance (US Units)

Type	WLVi		Type	WLVi	
			Bearings Oil Flow (P)	15.1	usgpm
Flow	81.90	lb/min	Injection Line (NP)	44.6	usgpm
	4914.3	lb/hr	Total Pumped Oil Flow (P)	15.1	usgpm
Skid Volume		+/-5%			
Comp. Volume	2911	acfm	Total Oil Flow (P+NP)	59.7	usgpm
Absorbed Shaft Power	737.1	hp	Minimum Oil Pump	26.1	usgpm
Absorbed Shaft Torque	1091	lb.ft	Oil Cooler Heat Rejection	19,543	Btu/min
Bearings Oil/Gas dP	+30	psid	Discharge Temperature	210	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	167	°F
Bearings Oil Flow (P)	15.1	usgpm	Injection Line (NP)	44.6	us gpm
Oil Cooler Heat Rejection	10,302	Btu/min			
			Total Oil Flow (P+NP)	59.7	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case D

Inlet Flange Pressure	2.85	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
619.2	100	100.0	549.7
557.3	90	92.4	507.9
495.3	80	83.3	457.9
433.4	70	74.3	408.4
371.5	60	65.7	361.1
309.6	50	57.7	317.2
247.7	40	50.5	277.6
185.8	30	44.3	243.5
123.8	20	39.2	215.5
61.9	10	35.3	194.0

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.002

Medium Stages

Non Pumped Lube Circuit

Case E

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	47.03	psia
	3.200	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	89.6	psia
	6.10	**Atm**

Oil Properties

Oil SP Heat	0.5283	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00159
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLVi			Type	WLVi	
				Bearings Oil Flow (P)	0.90	l/sec
Flow	2,506	kg/hr		Injection Line (NP)	2.69	l/sec
	696.1	g/sec		Total Pumped Oil Flow (P)	0.90	l/sec
Skid Volume			+/-5%			
Comp. Volume	4953	am3/hr		Total Oil Flow (P+NP)	3.58	l/sec
Absorbed Shaft Power	544.2	kW		Minimum Oil Pump	1.58	l/sec
Absorbed Shaft Torque	1463.8692	N.m		Oil Cooler Heat Rejection	318	kW
Oil/Gas dP	2.0684277	bar		Discharge Temperature	97	°C
Oil Temp.	48.9	°C				
Volumetric Efficiency	87.58	%				
Isothermal Efficiency	52.88	%				

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C		Discharge Temperature	74	°C
Bearings Oil Flow (P)	0.90	l/sec		Injection Line (NP)	2.69	l/sec
Oil Cooler Heat Rejection	167	kW				
				Total Oil Flow (P+NP)	3.6	l/sec

Full Load Performance (US Units)

Type	WLVi			Type	WLVi	
				Bearings Oil Flow (P)	14.2	usgpm
Flow	92.08	lb/min		Injection Line (NP)	42.6	usgpm
	5524.9	lb/hr		Total Pumped Oil Flow (P)	14.2	usgpm
Skid Volume			+/-5%			
Comp. Volume	2915	acfm		Total Oil Flow (P+NP)	56.8	usgpm
Absorbed Shaft Power	729.8	hp		Minimum Oil Pump	25.0	usgpm
Absorbed Shaft Torque	1080	lb.ft		Oil Cooler Heat Rejection	18,067	Btu/min
Bearings Oil/Gas dP	+30	psid		Discharge Temperature	207.4	°F
Oil Supply Temperature	120.0	°F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F		Discharge Temperature	166	°F
Bearings Oil Flow (P)	14.2	usgpm		Injection Line (NP)	42.6	us gpm
Oil Cooler Heat Rejection	9,468	Btu/min				
				Total Oil Flow (P+NP)	56.8	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLVi 321/165 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case E

Inlet Flange Pressure	3.20	Atm
Outlet Flange Pressure	6.10	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
696.1	100	100.0	544.2
626.5	90	92.3	502.3
556.9	80	82.9	451.2
487.3	70	73.6	400.5
417.7	60	64.7	352.1
348.1	50	56.5	307.5
278.5	40	49.0	266.7
208.8	30	42.5	231.3
139.2	20	37.2	202.4
69.6	10	33.2	180.7

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLViH 321/193 50 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

High Stages

Non Pumped Lube Circuit

Case A

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	15.43	psia
	1.050	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	293.9	psia
	20.00	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00052
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLViH		Type	WLViH	
			Bearings Oil Flow **(P)**	3.22	l/sec
Flow	793	kg/hr	Injection Line **(NP)**	8.76	l/sec
	220.3	g/sec	Total Pumped Oil Flow **(P)**	3.22	l/sec
Skid Volume		+/-5%			
Comp. Volume	4773	am3/hr	Total Oil Flow **(P+NP)**	11.99	l/sec
Absorbed Shaft Power	1229.6	kW	Minimum Oil Pump	4.98	l/sec
Absorbed Shaft Torque	3307.4457	N.m	Oil Cooler Heat Rejection	1,153	kW
Oil/Gas dP	3.10	bar	Discharge Temperature	102	°C
Oil Temp.	48.9	°C			
Volumetric Efficiency	74.75	%			
Isothermal efficiency	33.81	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	89	°C
Bearings Oil Flow **(P)**	3.22	l/sec	Injection Line **(NP)**	8.76	l/sec
Oil Cooler Heat Rejection	886	kW			
			Total Oil Flow **(P+NP)**	12.0	l/sec

Full Load Performance (US Units)

Type	WLViH		Type	WLViH	
			Bearings Oil Flow **(P)**	51.1	usgpm
Flow	29.15	lb/min	Injection Line **(NP)**	138.9	usgpm
	1748.8	lb/hr	Total Pumped Oil Flow **(P)**	51.1	usgpm
Skid Volume		+/-5%			
Comp. Volume	2809	acfm	Total Oil Flow **(P+NP)**	190.0	usgpm
Absorbed Shaft Power	1648.9	hp	Minimum Oil Pump	79.0	usgpm
Absorbed Shaft Torque	2439	lb.ft	Oil Cooler Heat Rejection	65,569	Btu/min
Bearings Oil/Gas dP	+45	psid	Discharge Temperature	215	°F
Oil Supply Temperature	120.0	°F	Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	193	°F
Bearings Oil Flow **(P)**	51.1	usgpm	Injection Line **(NP)**	138.9	us gpm
Oil Cooler Heat Rejection	50,373	Btu/min			
			Total Oil Flow **(P+NP)**	190.0	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLViH 321/193 50 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case A

Inlet Flange Pressure	1.05	Atm
Outlet Flange Pressure	20.00	Atm

PART LOAD DATA

Rated Each Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
220.3	100	100.0	1229.6
198.3	90	96.9	1191.5
176.3	80	93.1	1144.7
154.2	70	89.3	1098.0
132.2	60	85.4	1050.1
110.2	50	81.9	1007.0
88.1	40	78.6	966.5
66.1	30	75.9	933.3
44.1	20	73.8	907.4
22.0	10	72.5	891.4

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLViH 321/193 50 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

High Stages

Non Pumped Lube Circuit

Case B

1.013254 bar atmospheric — 0 Meters Elevation
14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	19.10	psia
	1.300	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	293.9	psia
	20.00	**Atm**

Oil Properties

Oil SP Heat 0.528 Btu/lb˚F
Oil SP Grav 0.8268
CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt. 4.0026 — Z Comp. Inlet 1.00065
Cp/Cv 1.6673453 — Water Content 0.000 % Mol

Full Load Performance (SI Units)

Type	WLViH		Type	WLViH	
			Bearings Oil Flow **(P)**	3.20	l/sec
Flow	986	kg/hr	Injection Line **(NP)**	8.73	l/sec
	273.8	g/sec	Total Pumped Oil Flow **(P)**	3.20	l/sec
Skid Volume					
Comp. Volume	4792	am3/hr	Total Oil Flow **(P+NP)**	11.92	l/sec
Absorbed Shaft Power	1311	kW	Minimum Oil Pump	4.94	l/sec
Absorbed Shaft Torque	4194	N.m	Oil Cooler Heat Rejection	1,212	kW
Oil/Gas dP	3.103	bar	Discharge Temperature	105	˚C
Oil Temp.	48.9	˚C			
Volumetric Efficiency	75.0	%			
Isothermal efficiency	36.6	%			

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	91	˚C
Bearings Oil Flow **(P)**	3.2	l/sec	Injection Line **(NP)**	8.73	l/sec
Oil Cooler Heat Rejection	916	kW			
			Total Oil Flow **(P+NP)**	11.9	l/sec

Full Load Performance (US Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow **(P)**	50.7	usgpm
	36.2	lb/min		Injection Line **(NP)**	138.3	usgpm
Flow	2173	lb/hr	+/-5%	Total Pumped Oil Flow **(P)**	50.7	usgpm
Skid Volume						
Comp. Volume	2820	acfm		Total Oil Flow **(P+NP)**	189.0	usgpm
Absorbed Shaft Power	1758.2	hp		Minimum Oil Pump	78.3	usgpm
Absorbed Shaft Torque	3093	lb.ft		Oil Cooler Heat Rejection	68,896	Btu/min
Bearings Oil/Gas dP	+45	psi		Discharge Temperature	220	˚F
Oil Supply Temperature	120.0	˚F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	196	˚F
Bearings Oil Flow **(P)**	50.70	usgpm	Injection Line **(NP)**	138.3	us gpm
Oil Cooler Heat Rejection	52,068	Btu/min			
			Total Oil Flow **(P+NP)**	189.0	usgpm

(P) = Pumped Oil **(NP)** = Non Pumped Oil

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Non Pumped main Oil Injection — Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ---------- Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ---------- Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow — Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Howden WLViH 321/193 50 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case B

Inlet Flange Pressure	1.30	Atm
Outlet Flange Pressure	20.00	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
273.8	100	100.0	1311.1
246.4	90	96.6	1266.5
219.0	80	92.4	1211.4
191.7	70	88.2	1156.3
164.3	60	84.2	1103.9
136.9	50	80.4	1054.1
109.5	40	77.0	1009.5
82.1	30	74.1	971.5
54.8	20	71.9	942.6
27.4	10	70.4	923.0

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLViH 321/193 34 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

High Stages

Non Pumped Lube Circuit

Case C

1.013254 bar atmospheric — 0 Meters Elevation

14.696 psi atmospheric — 0 Ft Elevation

Compressor Flanges

Inlet Pressure	36.74	psia
	2.500	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	293.9	psia
	20.00	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb˚F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00125
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	3.05	l/sec
Flow	1,916	kg/hr	+/-5%	Injection Line (NP)	8.37	l/sec
	532.3	g/sec		Total Pumped Oil Flow (P)	3.05	l/sec
Skid Volume						
Comp. Volume	4846	am3/hr		Total Oil Flow (P+NP)	13.69	l/sec
Absorbed Shaft Power	1615	kW		Minimum Oil Pump	4.72	l/sec
Absorbed Shaft Torque	4343	N.m		Oil Cooler Heat Rejection	1,418	kW
Oil/Gas dP	3.103	bar		Discharge Temperature	106	˚C
Oil Temp.	48.9	˚C				
Volumetric Efficiency	74.7	%				
Isothermal efficiency	43.9	%				

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	96 ˚C
Bearings Oil Flow (P)	3.1	l/sec	Injection Line (NP)	10.64 l/sec
Oil Cooler Heat Rejection	982	kW		
			Total Oil Flow (P+NP)	13.7 l/sec

Full Load Performance (US Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	48.4	usgpm
Flow	70.4	lb/min	+/-5%	Injection Line (NP)	132.6	usgpm
	4225	lb/hr		Total Pumped Oil Flow (P)	48.4	usgpm
Skid Volume				Auxiliary Oil Injection	36.0	usgpm
Comp. Volume	2852	acfm		Total Oil Flow (P+NP)	217.0	usgpm
Absorbed Shaft Power	2165.3	hp		Minimum Oil Pump	74.8	usgpm
Absorbed Shaft Torque	3203	lb.ft		Oil Cooler Heat Rejection	80,619	Btu/min
Bearings Oil/Gas dP	+45	psid		Discharge Temperature	222	˚F
Oil Supply Temperature	120.0	˚F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	205 ˚F
Bearings Oil Flow (P)	48.40	usgpm	Injection Line (NP)	168.6 us gpm
Oil Cooler Heat Rejection	55,816	Btu/min		
			Total Oil Flow (P+NP)	217.0 usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**

Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Auxiliary Oil Injection

Extra Oil required to undetermined port.

Howden WLViH 321/193 34 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case C

Inlet Flange Pressure	2.50	Atm
Outlet Flange Pressure	20.00	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
532.3	100	100.0	1614.7
479.1	90	95.2	1537.2
425.9	80	89.6	1446.8
372.6	70	84.2	1359.6
319.4	60	79.1	1277.2
266.2	50	74.3	1199.7
212.9	40	70.1	1131.9
159.7	30	66.5	1073.8
106.5	20	63.7	1028.6
53.2	10	61.8	997.9

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLViH 321/193 32 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.001

High Stages

Non Pumped Lube Circuit

Case D

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	44.09	psia
	3.000	**Atm**
Inlet Temp	94.73	˚F
	34.85	**˚C**
Outlet Press.	293.9	psia
	20.00	**Atm**

Oil Properties

Oil SP Heat 0.528 Btu/lb˚F
Oil SP Grav 0.8268
CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt. 4.0026
Cp/Cv 1.6673453
Z Comp. Inlet 1.00149
Water Content 0.000 % Mol

Full Load Performance (SI Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	3.00	l/sec
Flow	2,317	kg/hr		Injection Line (NP)	8.23	l/sec
	643.6	g/sec		Total Pumped Oil Flow (P)	3.00	l/sec
Skid Volume			+/-5%			
Comp. Volume	4883	am3/hr		Total Oil Flow (P+NP)	13.94	l/sec
Absorbed Shaft Power	1697.4	kW		Minimum Oil Pump	4.62	l/sec
Absorbed Shaft Torque	4565.7022	N.m		Oil Cooler Heat Rejection	1,458	kW
Oil/Gas dP	3.1026416	bar		Discharge Temperature	106	˚C
Oil Temp.	48.9	˚C				
Volumetric Efficiency	74.75	%				
Isothermal efficiency	46.09	%				

Minimum Load (SI Units)

Oil Supply Temperature	48.9	˚C	Discharge Temperature	97	˚C
Bearings Oil Flow (P)	3.00	l/sec	Injection Line (NP)	10.95	l/sec
Oil Cooler Heat Rejection	977	kW			
			Total Oil Flow (P+NP)	13.9	l/sec

Full Load Performance (US Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	47.5	usgpm
Flow	85.13	lb/min		Injection Line (NP)	130.5	usgpm
	5107.7	lb/hr		Total Pumped Oil Flow (P)	47.5	usgpm
Skid Volume			+/-5%	Auxiliary Oil Injection	43.0	usgpm
Comp. Volume	2874	acfm		Total Oil Flow (P+NP)	221.0	usgpm
Absorbed Shaft Power	2276.2	hp		Minimum Oil Pump	73.3	usgpm
Absorbed Shaft Torque	3367	lb.ft		Oil Cooler Heat Rejection	82,871	Btu/min
Bearings Oil/Gas dP	+45	psid		Discharge Temperature	223	˚F
Oil Supply Temperature	120.0	˚F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	˚F	Discharge Temperature	206	˚F
Bearings Oil Flow (P)	47.5	usgpm	Injection Line (NP)	173.5	us gpm
Oil Cooler Heat Rejection	55,515	Btu/min			
			Total Oil Flow (P+NP)	221.0	usgpm

(P) = Pumped Oil **(NP) = Non Pumped Oil**
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Auxiliary Oil Injection

Extra Oil required to undetermined port.

Howden WLViH 321/193 32 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case D

Inlet Flange Pressure	3.00	Atm
Outlet Flange Pressure	20.00	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
643.6	100	100.0	1697.4
579.2	90	94.7	1607.4
514.9	80	88.7	1505.6
450.5	70	82.8	1405.4
386.1	60	77.3	1312.1
321.8	50	72.2	1225.5
257.4	40	67.7	1149.1
193.1	30	63.9	1084.6
128.7	20	60.8	1032.0
64.4	10	58.7	996.3

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.

Howden WLViH 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Fluid	Mole %
HELIUM	100.000
M.W.	4.003
Cp/Cv	1.667
z1	1.003

High Stages

Non Pumped Lube Circuit

Case E

1.013254 bar atmospheric
14.696 psi atmospheric

0 Meters Elevation
0 Ft Elevation

Compressor Flanges

Inlet Pressure	85.24	psia
	5.800	**Atm**
Inlet Temp	94.73	°F
	34.85	**°C**
Outlet Press.	279.2	psia
	19.00	**Atm**

Oil Properties

Oil SP Heat	0.528	Btu/lb°F
Oil SP Grav	0.8268	

CPI®-4600-68 Lubricant

Gas Properties

Mol. Wt.	4.0026	Z Comp. Inlet	1.00289
Cp/Cv	1.6673453	Water Content	0.000 % Mol

Full Load Performance (SI Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	2.54	l/sec
Flow	4,620	kg/hr		Injection Line (NP)	7.05	l/sec
	1,283.4	g/sec		Total Pumped Oil Flow (P)	2.54	l/sec
Skid Volume			+/-5%			
Comp. Volume	5044	am3/hr		Total Oil Flow (P+NP)	13.38	l/sec
Absorbed Shaft Power	1840.7	kW		Minimum Oil Pump	3.92	l/sec
Absorbed Shaft Torque	4951.3707	N.m		Oil Cooler Heat Rejection	1,370	kW
Oil/Gas dP	3.1026416	bar		Discharge Temperature	105	°C
Oil Temp.	48.9	°C				
Volumetric Efficiency	74.75	%				
Isothermal efficiency	53.08	%				

Minimum Load (SI Units)

Oil Supply Temperature	48.9	°C	Discharge Temperature	105	°C
Bearings Oil Flow (P)	2.54	l/sec	Injection Line (NP)	10.83	l/sec
Oil Cooler Heat Rejection	767	kW			
			Total Oil Flow (P+NP)	13.4	l/sec

Full Load Performance (US Units)

Type	WLViH			Type	WLViH	
				Bearings Oil Flow (P)	40.3	usgpm
Flow	169.77	lb/min		Injection Line (NP)	111.7	usgpm
	10186.1	lb/hr		Total Pumped Oil Flow (P)	40.3	usgpm
Skid Volume			+/-5%	Auxiliary Oil Injection	60.0	usgpm
Comp. Volume	2969	acfm		Total Oil Flow (P+NP)	212.0	usgpm
Absorbed Shaft Power	2468.5	hp		Minimum Oil Pump	62.1	usgpm
Absorbed Shaft Torque	3652	lb.ft		Oil Cooler Heat Rejection	77,876	Btu/min
Bearings Oil/Gas dP	+45	psid		Discharge Temperature	221	°F
Oil Supply Temperature	120.0	°F		Injection Oil/Gas dP	-14.7	psid

Minimum Load (US Units)

Oil Temp.	120.0	°F	Discharge Temperature	220	°F
Bearings Oil Flow (P)	40.3	usgpm	Injection Line (NP)	171.7	us gpm
Oil Cooler Heat Rejection	43,632	Btu/min			
			Total Oil Flow (P+NP)	212.0	usgpm

(P) = Pumped Oil (NP) = Non Pumped Oil
Prepared by: Doug Szandrocha **Company: Howden Compressors Inc.**

Build Requires Superfeed + L.R.I. Ports not machined.

Non Pumped main Oil Injection

Pumped lubrication is required for all bearings and un-loader pressure regulated for constant Poil 30 psi > P2. Pumped oil filtered at 15 microns. Injection Oil at 1 bar below discharge filtered at 250 microns maximum particle size.

DRIVER ----------

Driver power should be at least 10% above full load power. In cases with engine drive, please consult Howden Compressors.

TOLERANCE ----------

Full load power and capacity have a tolerance of +/- 5% unless noted otherwise. Part load powers are not guaranteed.

Modified Oil Flow

Injection oil flow modified to a normal pumped rate with supply pressure at 14.7 psid BELOW discharge pressure.

Auxiliary Oil Injection

Extra Oil required to undetermined port.

Howden WLViH 321/193 22 on 100% Helium at 3550 rpm

Modified Injection Oil Flow

Case E

Inlet Flange Pressure	5.80	Atm
Outlet Flange Pressure	19.00	Atm

PART LOAD DATA

Rated Flow g/sec	Percentage Flow (%)	Absorbed Power (%)	Rated Shaft kW
1,283.4	100	100.0	1840.7
1,155.1	90	93.1	1713.7
1,026.7	80	85.0	1564.6
898.4	70	77.2	1421.0
770.1	60	69.8	1284.8
641.7	50	62.9	1157.8
513.4	40	56.8	1045.5
385.0	30	51.6	949.8
256.7	20	47.3	870.7
128.3	10	44.2	813.6

PERCENTAGE LOAD -------- Part load increments shown above are percentage of full load capacity rather than of slide valve position, which may not be in direct proportion to capacity.

MINIMUM LOAD ---------- Minimum load is normally 20% of full load, however this amount of turndown will not be achievable in every case.

TOLERANCE ---------- Part load powers are not guaranteed.