

Allison Transmission Bundled Report

Application	116-A353478-1
Iteration	1
Date	April 4, 2025 13:17:40
Units Of Measure	SI

The vehicle performance calculated by iSCAAN is an estimate for the specified vehicle and power train operating at standard engine conditions per SAE J1995 at 91 m (300 feet) altitude of 100 kPa barometric pressure and 25°C (77°F) inlet air temperature. Engine performance is significantly affected as operating altitude increases, therefore, Allison Transmission, Inc. does not represent and hereby disclaims that, under all conditions, the actual vehicle will achieve the simulated performance.

Application Profile

Application Name	Titan HET Z80 - Cummins X15 447kW 2779Nm - 4900
Owner	Andreas Wolf @ DGS Mainz
SCAAN Analysis Type	Standard Vehicle Run
Optional Analysis Type	
Classification	Standard
Review Status	Not Submitted

Mission

End User	Unknown
Selected Vocation	Heavy Haul — Equipment Hauler with Escort or Permit — Tractor Trailer (22-10-20)

Platform

Vehicle Manufacturer	Titan (Europe/ME/SA)
Vehicle Model	Z80
Vehicle Configuration	Tractor 6x6
Engine Rating	Cummins X 15 -- 447kW@2100rpm 2779Nm@1400rpm EU Stufe 3a FR11842 -- without SEM/LRTP (116-L032701-E, Rev C)
Transmission	4900 SP Retarder (1-L014454-T, Rev F)
Transmission Rating	4900 SP Retarder Specialty/Military - Diesel Allison 6th Generation Controls without SEM/LRTP (1-L017757-R, Rev G)
Vehicle Parameters	Standard
Torque Converter	TC571H (1-L014461-TC, Rev A) - Recommended
Transmission Retarder	4000 Series High Capacity (1-L004745-TR, Rev E)
LRTP Status	

Allison Transmission Input Summary

Mission

End User	Unknown
Selected Vocation	Heavy Haul — Equipment Hauler with Escort or Permit — Tractor Trailer (22-10-20)

Platform

Vehicle Manufacturer	Titan (Europe/ME/SA)
Vehicle Model	Z80
Vehicle Configuration	Tractor 6x6
User Expected Engine Load	0%

Platform - Area and Weight

Frontal Area	14.000 m²
Height / Width	4.000 m / 3.500 m
Standard Wind Resistance Coefficient	0.800 (no Deflector)
User Defined Wind Resistance Coefficient	0.800 (no Deflector)
Gross Combined Weight	180000 kg (with Trailer)
Weight On Drive Wheels	78000 kg (43.33%)

Platform - Tires

Number Of Tires	6 (High Flotation (Terra))
Selected Tire	
Tire Revolutions	200 revs/km
Tire Rolling Radius	0.794 m
Standard Surface	Smooth Concrete (SC Factor = 1.00)
Selected Surface	Smooth Concrete (SC Factor = 1.00)
Standard On-Road Traction Limit Coefficient	0.700
Standard Off-Road Traction Limit Coefficient	0.000
User Defined On-Road Traction Limit Coefficient	0.700
User Defined Off-Road Traction Limit Coefficient	0.000
Tire/Wheel Inertia (estimated)	1373.3387 kg-m²

Accessory Losses (Power @ Governed Speed)

Accessory	Standard Loss (kW)	User Defined Loss (kW)
Fan (Clutch Fan)	29.1	29.1
Alternator / Generator	2.2	2.2
Air Compressor	2.2	2.2
Steering Pump	2.2	2.2
Air Conditioning	0.0	0.0
Implement Drive	0.0	0.0

Engine

Number of Power Packs	1
Engine Rating	Cummins X 15 -- 447kW@2100rpm 2779Nm@1400rpm EU Stufe 3a FR11842 -- without SEM/LRTP (116-L032701-E, Rev C)
Engine Controls Type	Electronic
Evaluate at Altitude	No
Certifications	
Displacement	14.90 l
Peak Torque	2779.0 N-m
Peak Torque Speed	1400 rpm
Peak Power	446.9 kW
Peak Power Speed	2100 rpm
Governed Power	446.9 kW
Governed Speed	2100 rpm
Number Of Curves	1
Engine Curve Reference	FR11847
Cruise Velocity @ Speed	0.0 km/h @ 0 rpm
Engine Retarder	
Engine Inertia (estimated)	1.8370 kg-m²
Engine Idle Speed	700 rpm

Engine Curve - Standard Losses - Combined Low & High Curves (AC On Where Applicable)

Speed (rpm)	Gross Power (kW)	Gross Torque (N-m)	Net Power Fan On (kW)	Net Torque Fan On (N-m)	Net Power Fan Off (kW)	Net Torque Fan Off (N-m)	Point Identification
700	96.9	1322.0	92.1	1256.4	93.2	1271.1	
800	130.6	1559.0	125.1	1492.8	126.7	1512.0	
900	178.9	1898.0	172.4	1829.6	174.7	1853.9	
1000	234.3	2237.0	226.7	2165.3	229.9	2195.3	
1100	281.6	2445.0	272.9	2369.0	277.1	2405.2	
1200	332.3	2644.0	322.0	2562.7	327.5	2605.9	
1300	371.0	2725.0	359.1	2637.5	366.0	2688.2	
1400	407.4	2779.0	393.6	2684.6	402.2	2743.4	Peak Torque
1500	421.0	2680.0	404.9	2577.9	415.5	2645.4	
1600	432.5	2581.0	413.9	2470.5	426.8	2547.3	
1700	442.0	2483.0	420.7	2363.4	436.2	2450.1	
1800	446.7	2370.0	422.3	2240.6	440.7	2337.8	
1900	446.9	2246.0	419.1	2106.2	440.6	2214.4	
2000	446.9	2134.0	415.3	1983.0	440.4	2103.0	
2100	446.9	2032.0	411.1	1869.2	440.1	2001.5	Peak Governed
2230	0.0	0.0	-41.8	-179.0	-7.0	-29.9	No Load Governed

Engine Curve - User Defined Losses - Combined Low & High Curves (AC On Where Applicable)

Speed (rpm)	Gross Power (kW)	Gross Torque (N-m)	Net Power Fan On (kW)	Net Torque Fan On (N-m)	Net Power Fan Off (kW)	Net Torque Fan Off (N-m)	Point Identification
700	96.9	1322.0	92.1	1256.4	93.2	1271.1	
800	130.6	1559.0	125.1	1492.8	126.7	1512.0	
900	178.9	1898.0	172.4	1829.6	174.7	1853.9	
1000	234.3	2237.0	226.7	2165.3	229.9	2195.3	
1100	281.6	2445.0	272.9	2369.0	277.1	2405.2	
1200	332.3	2644.0	322.0	2562.7	327.5	2605.9	
1300	371.0	2725.0	359.1	2637.5	366.0	2688.2	
1400	407.4	2779.0	393.6	2684.6	402.2	2743.4	Peak Torque
1500	421.0	2680.0	404.9	2577.9	415.5	2645.4	
1600	432.5	2581.0	413.9	2470.5	426.8	2547.3	
1700	442.0	2483.0	420.7	2363.4	436.2	2450.1	
1800	446.7	2370.0	422.3	2240.6	440.7	2337.8	
1900	446.9	2246.0	419.1	2106.2	440.6	2214.4	
2000	446.9	2134.0	415.3	1983.0	440.4	2103.0	
2100	446.9	2032.0	411.1	1869.2	440.1	2001.5	Peak Governed
2230	0.0	0.0	-41.8	-179.0	-7.0	-29.9	No Load Governed

Transmission

Transmission Manufacturer	Allison Transmission
Transmission Family	4000 Series (1-L001323-TF, Rev U)
Transmission	4900 SP Retarder (1-L014454-T, Rev F)
Transmission Rating	4900 SP Retarder Specialty/Military - Diesel Allison 6th Generation Controls without SEM/LRTP (1-L017757-R, Rev G)
Torque Converter	TC571H (1-L014461-TC, Rev A) - Recommended
Transmission Retarder	4000 Series High Capacity (1-L004745-TR, Rev E)

Controls

Controls Release	Production Calibration (PC) for 4000 Series (1-L007292-CR, Rev E)
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Controls - Primary Gears (Shift Schedule)

DynActive	No
Speed Profile	Performance
Shift Speed & Strategy	2100 rpm S1 Performance
Equivalent DynActive Bias	0
Primary Mode: Gears	Low = 1, Start = 2, High = 7 (1-2-7)

Driveline

Transmission Output Torque Limit	No
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Driveline - Components

Component	Description	Ratio	Standard Efficiency (%)	User Defined Efficiency (%)
Propshaft -- One Piece -- Two Joint (1-L003521-DL)	Single	1.000	98.60	98.60
Axle -- Off Hwy Single Red -- 6x6 (1-L003573-DL)	Single	16.140	88.40	88.40
Aux Gearing -- Transfer Case -- Two Speed (1-L003523-DL)	Low	2.040	97.00	97.00
Aux Gearing -- Transfer Case -- Two Speed (1-L003523-DL)	High	1.030	97.00	97.00

Driveline - Overall Driveline Ratio

Description	Ratio	Standard Efficiency (%)	User Defined Efficiency (%)	N over V Ratio (rpm/kph)
High	16.624	84.55	84.55	55.526
Low	32.926	84.55	84.55	109.974

Allison Transmission Ratings and Guidelines Check

Note

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Results indicate the vehicle operating conditions at steady state (acceleration = 0).
The exclamation symbol indicates that Wheel Slip may occur.

Converter Rating And Guideline Checks

		Section Score - OK	
C01		Transmission / Converter Compatibility	
Overall Status		OK: Acceptable	
C02		Engine / Converter Compatibility	
Overall Status		OK: Acceptable	
C04		Engine Speed at Converter Stall	
Overall Status		Reference	
Actual		1603 rpm	
C05		Minimum Engine Speed	
Overall Status		OK: Acceptable	
Rating/Recommendation		1500 rpm (Min)	
Actual		1551 rpm	
Notes		Net peak torque speed (1400 rpm) + allowable variation (100 rpm).	
C10		Torque Converter Input Torque	
Overall Status		OK: Acceptable	
Rating/Recommendation		3200.0 N-m (Max)	
Actual		2779.0 N-m	
C07		Turbine Torque at Converter Stall	
Overall Status		OK: Acceptable	
Rating/Recommendation		4101.0 N-m (Max)	
Actual		3951.4 N-m	
C08		Converter Speed Ratio at Engine Governed Speed	
Overall Status		OK: Acceptable	
Rating/Recommendation		0.800 (Min)	
Actual		0.891	
C03		Converter Stall Torque Ratio	
Overall Status		Reference	
Actual		1.620	

Transmission Rating And Guideline Checks

! Section Score - XX		
T01	!	Transmission / Vocation Compatibility
Overall Status	XX: Questionable - may not be acceptable	
T02	✓	Transmission / Engine Compatibility
Overall Status	OK: Acceptable	
T17	✓	Transmission Permitted in End User/Chassis Mfg Locations
Overall Status	OK: Acceptable	
T15	✓	Transmission Input Power (Gross)
Overall Status	OK: Acceptable	
Rating/Recommendation	597.0 kW (Max)	
Actual	447.0 kW	
T14	✓	Transmission Input Torque (Gross)
Overall Status	OK: Acceptable	
Rating/Recommendation	3200.0 N-m (Max)	
Actual	2779.0 N-m	
T03	✓	Transmission Input Speed
Overall Status	OK: Acceptable	
Rating/Recommendation	1700 rpm / 2300 rpm	
Actual	2100 rpm	
T04	📖	Transmission Output Speed
Overall Status	Reference	
Actual	3286 rpm	
Notes	Check made in Range 7L at 2100 rpm Engine Governed Speed.	

Vehicle Rating And Guideline Checks - Standard

! Section Score - C		
V22	📖	2nd Range Converter Stall Gradeability
Overall Status	Reference	
Actual	26.54 %	
V47	📖	2nd Range 80% Converter Efficiency Gradeability
Overall Status	Reference	
Actual	15.951	
V16	✓	Gradeability Required at Governed Speed
Overall Status	OK: Acceptable	
Rating/Recommendation	8.00 % (Min)	
Actual	25.66 %	
Notes	Check is in Lockup Mode.	
V17	📖	Maximum Geared Vehicle Speed at Engine Governed Speed
Overall Status	Reference	
Actual	59.2 km/h	
Notes	Check is in 7L Lockup.	
V18	!	Maximum Speed on 0.5% Grade
Overall Status	C: Consider - manufacturer to assess	
Rating/Recommendation	104.6 km/h (Min)	
Actual	34.3 km/h	
Notes	At 1907.1 rpm Engine Speed, Range 5L.	
V45	📖	Heat Generated in 2nd Range 80% Converter Efficiency
Overall Status	Reference	
Actual	97.48 kW	
Notes	At 1780.5 rpm Engine Speed.	

Allison Transmission
Vehicle Performance Summary

Note

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Full Throttle, Automatic Upshifts (Gradeability)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	2.040

Gradeability	Percent Grade	Vehicle Speed (km/h)	Gear Range	Match Point
Stall Gradeability	26.5	0.0	2C	Stall
Launch Gradeability	24.5	0.0	2C	
Low Speed Gradeability	16.0	3.2	2C	80 Percent
Maximum Speed on Grade	0.0	30.3	7L	Road Load
	0.3	30.1	7L	
	0.5	29.9	7L	
	1.0	25.8	7L	
	2.0	18.5	6L	
	3.0	15.2	5L	
	4.0	12.4	4L	
	5.0	10.6	4L	
	6.0	9.2	3L	
	7.0	8.2	3L	
	8.0	7.0	3L	
	9.0	5.0	3C	
	10.0	4.1	3C	

Full Throttle, Automatic Upshifts (Gradeability)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	1.030

Gradeability	Percent Grade	Vehicle Speed (km/h)	Gear Range	Match Point
Stall Gradeability	12.3	0.0	2C	Stall
Launch Gradeability	10.3	0.0	2C	
Low Speed Gradeability	7.2	6.4	2C	80 Percent
Maximum Speed on Grade	0.0	41.7	6L	Road Load
	0.3	36.3	5L	
	0.5	32.9	5L	
	1.0	25.5	4L	
	2.0	19.1	3L	
	3.0	15.0	3L	
	4.0	8.9	3C	
	5.0	8.1	2C	
	6.0	7.7	2C	
	7.0	6.6	2C	
	8.0	5.5	2C	
	9.0	4.5	2C	
	10.0	3.5	2C	

Full Throttle, Automatic Upshifts (Acceleration)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	2.040

Speed (km/h)	Time (sec)	Distance (m)
0 - 20 km/h	13.9	52
0 - 30 km/h	Not Possible	Not Possible
0 - 40 km/h	Not Possible	Not Possible
0 - 60 km/h	Not Possible	Not Possible
0 - 80 km/h	Not Possible	Not Possible
0 - 100 km/h	Not Possible	Not Possible

Full Throttle, Automatic Upshifts (Acceleration)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	1.030

Speed (km/h)	Time (sec)	Distance (m)
0 - 20 km/h	15.2	54
0 - 30 km/h	41.8	245
0 - 40 km/h	180.1	1671
0 - 60 km/h	Not Possible	Not Possible
0 - 80 km/h	Not Possible	Not Possible
0 - 100 km/h	Not Possible	Not Possible

Allison Transmission Vehicle Full Throttle Performance

Note

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Results indicate the vehicle operating conditions at steady state (acceleration = 0).
The exclamation symbol indicates that Wheel Slip may occur.

Full Throttle, Automatic Upshifts (2C-3C-3L-4L-5L-6L-7L)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	2.040	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point	
2C	0.0	1603	0	481.06	452.81	0.0	26.54	414.28		
2C	0.8	1571	89	449.34	421.10	100.4	24.56	292.61		
2C	1.6	1567	177	412.94	384.70	184.6	22.33	192.73		
2C	2.4	1653	261	363.49	335.25	239.4	19.34	134.46	70 Percent	
2C	2.4	1659	266	360.57	332.32	241.8	19.17	132.01		
2C	3.2	1779	354	306.87	278.63	274.4	15.98	97.53		
2C	3.2	1781	355	306.31	278.06	274.6	15.95	97.28	80 Percent	
2C	4.0	1906	443	257.25	228.99	287.5	13.08	78.83		
2C	4.1	1911	447	255.13	226.88	287.7	12.96	78.33	85 Percent	
2C	4.1	1915	449	253.89	225.64	287.9	12.89	78.02		
3C	4.1	1633	449	203.93	175.67	231.2	10.00	142.72		
3C	4.8	1687	531	189.01	160.76	253.5	9.15	120.09		
3C	5.6	1753	620	173.23	144.97	271.0	8.24	101.04		
3C	6.4	1823	708	158.07	129.81	282.7	7.37	87.30		
3C	6.7	1846	738	153.09	124.83	285.3	7.09	83.39		
3L	6.7	1407	738	174.02	145.76	324.3	8.29	10.74		
3L	7.2	1518	797	166.05	137.78	334.0	7.83	11.50		
3L	8.0	1687	885	153.96	125.68	344.1	7.14	12.85		
3L	8.9	1856	974	139.81	111.53	343.8	6.33	13.93		
3L	9.7	2024	1062	125.71	97.42	337.2	5.53	15.49		
4L	9.7	1518	1062	124.85	96.56	334.9	5.48	10.47		
4L	10.5	1644	1151	117.99	89.69	342.8	5.09	11.45		
4L	11.3	1771	1239	110.59	82.28	346.1	4.67	12.57		
4L	12.1	1897	1328	102.16	73.85	342.5	4.19	14.01		
4L	12.9	2024	1416	94.35	66.02	337.4	3.74	15.22		
4L	12.9	2025	1417	94.28	65.96	337.4	3.74	15.23		
5L	12.9	1417	1417	91.22	62.89	326.4	3.57	9.46		
5L	13.7	1505	1505	87.83	59.49	333.7	3.37	10.64		
5L	14.5	1593	1593	84.38	56.04	339.5	3.18	11.79		
5L	15.3	1682	1682	80.96	52.60	343.8	2.98	12.86		
5L	16.1	1770	1770	77.15	48.78	344.9	2.76	13.94		
5L	16.9	1859	1859	73.01	44.63	342.7	2.53	15.08		
5L	17.7	1947	1947	68.94	40.54	339.0	2.30	16.34		
5L	18.4	2025	2025	65.59	37.18	335.4	2.11	17.54		
6L	18.4	1492	2025	63.82	35.40	326.3	2.01	18.11		
6L	18.5	1500	2036	63.59	35.18	326.9	1.99	18.32		
6L	19.3	1566	2124	61.72	33.30	331.1	1.89	19.22		
6L	20.1	1631	2213	59.86	31.42	334.5	1.78	20.39		
6L	20.9	1696	2301	58.01	29.55	337.1	1.67	21.74		
6L	21.7	1761	2390	55.91	27.44	337.4	1.55	22.62		
6L	22.5	1827	2478	53.73	25.23	336.2	1.43	23.78		
6L	23.3	1892	2567	51.42	22.91	333.3	1.30	25.08		
6L	24.1	1957	2655	49.29	20.76	330.5	1.18	26.01		
6L	24.9	2022	2744	47.23	18.68	327.3	1.06	27.29		
6L	25.0	2025	2747	47.16	18.61	327.2	1.05	27.32		
7L	25.0	1755	2747	47.93	19.38	332.5	1.10	28.35		
7L	25.7	1810	2832	46.37	17.80	331.7	1.01	29.74		
7L	26.6	1866	2921	44.61	16.02	329.1	0.91	30.97		
7L	27.4	1923	3009	42.90	14.29	326.0	0.81	32.58		
7L	28.2	1980	3098	41.27	12.63	322.9	0.72	34.23		
7L	29.0	2036	3186	39.71	11.06	319.6	0.63	35.82		
7L	29.8	2093	3275	38.21	9.52	316.0	0.54	37.67		
7L	29.9	2100	3286	38.01	9.33	315.5	0.53	37.97	Governed	
7L	30.6	2149	3363	20.72	-7.98	176.0	-0.45	37.94		
7L	31.4	2206	3452	0.86	-27.87	7.5	-1.58	37.85		
7L	31.4	2208	3456	0.00	-28.73	0.0	-1.63	37.85		

Full Throttle, Manual Hold (7.6269 Ratio) (1C-1L)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	2.040

Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point
1C!	0.0	1603	0	1034.32	1006.07	0.0	69.36	414.28	
1C!	0.8	1579	89	867.98	839.73	194.0	54.08	182.63	
1C!	1.1	1653	120	779.44	751.20	236.2	47.03	138.19	70 Percent
1C!	1.5	1781	163	655.88	627.63	270.6	38.04	102.01	80 Percent
1C!	1.6	1823	177	619.15	590.90	276.8	35.52	94.24	
1C!	1.7	1863	190	584.89	556.65	280.6	33.23	88.36	
1L!	1.7	1449	190	670.14	641.90	321.5	39.04	18.86	
1L	2.4	2025	266	489.62	461.37	328.3	27.08	25.94	
1L	2.5	2100	275	466.91	438.67	324.7	25.66	27.09	Governed
1L	2.6	2214	290	-2.66	-30.90	-1.9	-1.75	20.38	

Full Throttle, Manual Hold (3.5102 Ratio) (2C-2L)

Engine Fan	Air Conditioning	Engine Power	Vehicle Parameters	Axle Ratio	Auxiliary Gearing Ratio
On	Off	Standard Power Curve	Standard	16.140	2.040

Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point
2C	0.0	1603	0	481.06	452.81	0.0	26.54	414.28	
2C	0.8	1571	89	449.34	421.10	100.4	24.56	292.61	
2C	1.6	1567	177	412.94	384.70	184.6	22.33	192.73	
2C	2.4	1653	261	363.49	335.25	239.4	19.34	134.46	70 Percent
2C	2.4	1659	266	360.57	332.32	241.8	19.17	132.01	
2C	3.2	1779	354	306.87	278.63	274.4	15.98	97.53	
2C	3.2	1781	355	306.31	278.06	274.6	15.95	97.28	80 Percent
2C	3.3	1786	359	303.99	275.74	275.6	15.82	96.19	
2L	3.3	1260	359	310.38	282.14	281.4	16.19	11.47	
2L	4.0	1553	443	299.31	271.06	334.5	15.54	14.11	
2L	4.8	1864	531	254.17	225.92	340.9	12.90	17.07	
2L	5.4	2100	598	219.01	190.75	330.9	10.87	19.70	Governed
2L	5.6	2175	620	75.53	47.27	118.2	2.68	17.79	
2L	5.7	2214	631	-0.31	-28.57	-0.5	-1.62	16.71	

Full Throttle, Automatic Upshifts (2C-3C-3L-4L-5L-6L-7L)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	1.030	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point	
2C	0.0	1603	0	242.89	214.64	0.0	12.25	414.28		
2C	1.6	1570	89	226.73	198.48	101.4	11.32	291.49		
2C	3.2	1569	179	207.97	179.72	185.9	10.23	191.28		
2C	4.7	1653	261	183.53	155.27	239.4	8.83	134.46	70 Percent	
2C	4.8	1662	268	181.24	152.99	243.1	8.70	130.70		
2C	6.4	1781	355	154.65	126.39	274.6	7.18	97.28	80 Percent	
2C	6.4	1784	358	153.92	125.66	275.2	7.14	96.59		
2C	8.0	1911	447	128.81	100.54	287.7	5.70	78.33	85 Percent	
2C	8.0	1912	447	128.74	100.46	287.8	5.70	78.29		
2C	8.1	1915	449	128.19	99.92	287.9	5.67	78.02		
3C	8.1	1633	449	102.96	74.69	231.2	4.23	142.72		
3C	9.7	1691	536	94.96	66.67	254.7	3.78	118.91		
3C	11.3	1758	626	86.92	58.62	272.0	3.32	99.98		
3C	12.9	1829	715	79.22	50.90	283.3	2.88	86.32		
3C	13.3	1846	738	77.30	48.97	285.3	2.78	83.39		
3L	13.3	1407	738	87.86	59.53	324.3	3.37	10.74		
3L	14.5	1533	804	83.30	54.95	335.1	3.11	11.53		
3L	16.1	1704	894	77.12	48.74	344.7	2.76	13.06		
3L	17.7	1874	983	69.77	41.37	343.1	2.34	14.15		
3L	19.1	2024	1062	63.48	35.05	337.2	1.99	15.49		
4L	19.1	1518	1062	63.04	34.62	334.9	1.96	10.47		
4L	19.3	1533	1073	62.63	34.20	336.0	1.94	10.51		
4L	20.9	1660	1162	59.13	30.67	343.6	1.74	11.60		
4L	22.5	1788	1251	55.29	26.80	346.1	1.52	12.86		
4L	24.1	1916	1341	50.99	22.46	341.9	1.27	14.07		
4L	25.5	2025	1417	47.60	19.04	337.4	1.08	15.23		
5L	25.5	1417	1417	46.06	17.49	326.4	0.99	9.46		
5L	25.7	1430	1430	45.80	17.23	327.6	0.98	9.53		
5L	27.4	1519	1519	44.05	15.44	334.8	0.87	10.70		
5L	29.0	1609	1609	42.30	13.64	340.4	0.77	11.98		
5L	30.6	1698	1698	40.55	11.85	344.4	0.67	13.23		
5L	32.2	1788	1788	38.57	9.81	344.8	0.56	14.31		
5L	33.8	1877	1877	36.42	7.61	341.9	0.43	15.43		
5L	35.4	1966	1966	34.38	5.52	338.1	0.31	16.64		
5L	36.5	2025	2025	33.12	4.22	335.4	0.24	17.54		
6L	36.5	1492	2025	32.22	3.32	326.3	0.19	18.11		
6L	37.0	1515	2056	31.89	2.97	327.9	0.17	18.44		
6L	38.6	1581	2145	30.94	1.96	332.0	0.11	19.57		
6L	40.2	1647	2234	30.00	0.95	335.2	0.05	20.63		
6L	41.8	1713	2324	29.03	-0.08	337.4	0.00	21.93		
6L	43.5	1779	2413	27.95	-1.23	337.3	-0.07	23.01		
6L	45.1	1844	2503	26.81	-2.44	335.5	-0.14	24.02		
6L	46.7	1910	2592	25.65	-3.67	332.5	-0.21	25.39		
6L	48.3	1976	2681	24.57	-4.82	329.6	-0.27	26.42		
6L	49.5	2025	2747	23.81	-5.64	327.2	-0.32	27.32		
7L	49.5	1755	2747	24.20	-5.25	332.5	-0.30	28.35		
7L	49.9	1771	2771	23.99	-5.49	332.4	-0.31	28.73		
7L	51.5	1828	2860	23.13	-6.42	330.9	-0.36	30.02		
7L	53.1	1885	2950	22.24	-7.40	328.0	-0.42	31.58		
7L	54.7	1942	3039	21.39	-8.34	325.1	-0.47	33.02		
7L	56.3	1999	3128	20.55	-9.26	321.6	-0.52	35.01		
7L	57.9	2056	3218	19.78	-10.12	318.4	-0.57	36.38		
7L	59.2	2100	3286	19.19	-10.78	315.5	-0.61	37.97	Governed	
7L	59.5	2113	3307	16.85	-13.15	278.7	-0.74	37.97		
7L	61.2	2170	3396	6.73	-23.37	114.3	-1.32	37.91		
7L	62.2	2208	3456	0.00	-30.16	0.0	-1.71	37.85		

Full Throttle, Manual Hold (7.6269 Ratio) (1C-1L)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	1.030	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point	
1C	0.0	1603	0	522.23	493.99	0.0	29.15	414.28		
1C	1.6	1580	89	437.09	408.84	195.4	23.81	181.13		
1C	2.2	1653	120	393.54	365.30	236.2	21.15	138.19	70 Percent	
1C	2.9	1781	163	331.15	302.91	270.6	17.42	102.01	80 Percent	
1C	3.2	1829	179	310.28	282.03	277.4	16.19	93.31		
1C	3.4	1863	190	295.31	267.06	280.6	15.31	88.36		
1L	3.4	1449	190	338.36	310.11	321.5	17.85	18.86		
1L	4.8	2045	268	244.16	215.91	327.5	12.32	26.11		
1L	5.0	2100	275	235.75	207.49	324.7	11.84	27.09	Governed	
1L	5.2	2214	290	-1.16	-29.42	-1.7	-1.67	20.38		

Full Throttle, Manual Hold (3.5102 Ratio) (2C-2L)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	1.030	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point	
2C	0.0	1603	0	242.89	214.64	0.0	12.25	414.28		
2C	1.6	1570	89	226.73	198.48	101.4	11.32	291.49		
2C	3.2	1569	179	207.97	179.72	185.9	10.23	191.28		
2C	4.7	1653	261	183.53	155.27	239.4	8.83	134.46	70 Percent	
2C	4.8	1662	268	181.24	152.99	243.1	8.70	130.70		
2C	6.4	1781	355	154.65	126.39	274.6	7.18	97.28	80 Percent	
2C	6.4	1784	358	153.92	125.66	275.2	7.14	96.59		
2C	6.5	1786	359	153.49	125.22	275.6	7.11	96.19		
2L	6.5	1260	359	156.71	128.45	281.4	7.30	11.47		
2L	8.0	1569	447	150.10	121.83	335.5	6.92	14.29		
2L	9.7	1882	536	126.80	98.51	340.1	5.59	17.36		
2L	10.8	2100	598	110.58	82.28	330.9	4.67	19.70	Governed	
2L	11.3	2196	626	17.46	-10.84	54.7	-0.61	17.21		
2L	11.4	2214	631	0.00	-28.31	0.0	-1.60	16.72		

Full Throttle, Reverse Performance (Standard 4.801 Ratio) (R1C-R1C)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	2.040	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)	Match Point	
R1C!	0.0	1603	0	641.70	613.45	0.0	37.06	414.28		
R1C!	0.8	1556	89	588.05	559.81	131.4	33.44	254.60		
R1C	1.6	1631	177	503.35	475.10	225.0	27.95	149.94		
R1C	1.7	1653	191	488.11	459.87	235.0	26.98	139.63	70 Percent	
R1C	2.4	1781	260	412.10	383.85	270.1	22.28	102.60	80 Percent	
R1C	2.4	1792	266	405.78	377.53	272.1	21.89	100.43		
R1C	3.0	1911	327	343.86	315.61	283.5	18.17	83.31	85 Percent	
R1C	3.2	1971	354	318.48	290.24	284.7	16.67	79.65		
R1C	3.5	2100	390	293.18	264.93	288.6	15.18	69.80	Governed	
R1C	4.0	2180	443	89.28	61.03	99.8	3.46	21.68		
R1C	4.2	2214	464	2.02	-26.23	2.4	-1.49	14.55		

Full Throttle, Reverse Performance (Optional 17.120 Ratio - LRTP Required) (R2C-R2C)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	2.040	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)		Match Point
R2C!	0.0	1603	0	2278.92	2250.68	0.0	999.00	414.28		
R2C!	0.5	1653	53	1735.06	1706.81	234.2	379.10	140.56		70 Percent
R2C!	0.7	1781	73	1465.31	1437.07	269.3	140.19	103.57		80 Percent
R2C!	0.8	1890	89	1260.02	1231.77	281.6	97.42	86.30		
R2C!	0.8	1911	92	1223.09	1194.84	282.8	91.96	84.21		85 Percent
R2C!	1.0	2100	109	1043.24	1014.99	287.9	70.28	70.58		Governed
R2C	1.2	2214	130	9.40	-18.84	3.1	-1.07	13.70		

Full Throttle, Reverse Performance (Standard 4.801 Ratio) (R1C-R1C)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	1.030	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)		Match Point
R1C	0.0	1603	0	323.99	295.75	0.0	16.99	414.28		
R1C	1.6	1555	89	296.66	268.41	132.6	15.38	253.16		
R1C	3.2	1633	179	253.17	224.92	226.4	12.85	148.54		
R1C	3.4	1653	191	246.45	218.20	235.0	12.46	139.63		70 Percent
R1C	4.7	1781	260	208.07	179.82	270.1	10.24	102.60		80 Percent
R1C	4.8	1798	268	203.50	175.24	272.9	9.98	99.55		
R1C	5.9	1911	327	173.61	145.35	283.5	8.26	83.31		85 Percent
R1C	6.4	1981	358	159.47	131.20	285.2	7.45	78.79		
R1C	7.0	2100	390	148.03	119.76	288.6	6.80	69.80		Governed
R1C	8.0	2187	447	36.36	8.09	81.3	0.46	19.67		
R1C	8.4	2214	464	1.02	-27.26	2.4	-1.54	14.55		

Full Throttle, Reverse Performance (Optional 17.120 Ratio - LRTP Required) (R2C-R2C)

Engine Fan		Air Conditioning		Engine Power		Vehicle Parameters		Axle Ratio	Auxiliary Gearing Ratio	
On		Off		Standard Power Curve		Standard		16.140	1.030	
Gear Range	Vehicle Speed (km/h)	Engine Speed (rpm)	Output Speed (rpm)	Tractive Effort (kN)	Drawbar Pull (kN)	Wheel Power Available (kW)	Net Grade (%)	Transmission Heat Rejection (kW)		Match Point
R2C!	0.0	1603	0	1150.63	1122.39	0.0	82.38	414.28		
R2C!	1.0	1653	53	876.03	847.79	234.2	54.76	140.56		70 Percent
R2C!	1.3	1781	73	739.84	711.60	269.3	44.05	103.57		80 Percent
R2C!	1.6	1896	89	630.81	602.57	282.0	36.32	85.67		
R2C!	1.6	1911	92	617.54	589.29	282.8	35.42	84.21		85 Percent
R2C	2.0	2100	109	526.73	498.49	287.9	29.44	70.58		Governed
R2C	2.3	2214	130	4.75	-23.50	3.1	-1.33	13.70		