Commission Regulation (EU) 2017/2400 of 12 December 2017 implementing Regulation (EC) No 595/2009 of the European Parliament and of the Council as regards the determination of the CO2 emissions and fuel consumption of heavy-duty vehicles and amending Directive 2007/46/EC of the European Parliament and of the Council and Commission Regulation (EU) No 582/2011 (Text with EEA relevance)

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ANNEX IX

VERIFYING TRUCK AUXILIARY DATA

3. Determination of technology specific average standard power values

3.1 Fan

For the fan power the standard values shown in Table 1 shall be used depending on mission profile and technology:

TABLE 1

Mechanical power demand of the fan

Fan drive cluster	Fan control	Fan power consumption [W]				
		Long haul	Regional delivery	Urban delivery	Municipal utility	Construction
Crankshaft mounted	Electronically controlled visco clutch	618	671	516	566	1 037
	Bimetallic controlled visco clutch	818	871	676	766	1 277
	Discrete step clutch	668	721	616	616	1 157
	On/off cluch	718	771	666	666	1 237
Belt driven or driven via transmission	Electronic controlled visco clutch	989	1 044	833	933	1 478
	Bimetallic controlled visco clutch	1 189	1 244	993	1 133	1 718
	Discrete step clutch	1 039	1 094	983	983	1 598
	On/off cluch	1 089	1 144	1 033	1 033	1 678
Hydraulically driven	Variable displacement pump	938	1 155	832	917	1 872
	Constant displacement pump	1 200	1 400	1 000	1 100	2 300
Electrically driven	Electronically	700	800	600	600	1 400

If a new technology within a fan drive cluster (e.g. crankshaft mounted) cannot be found in the list the highest power values within that cluster shall be taken. If a new technology cannot be

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found in any cluster the values of the worst technology at all shall be taken (hydraulic driven constant displacement pump)

3.2 Steering System

For the steering pump power the standard values [W] shown in Table 2 shall be used depending on the application in combination with correction factors:

[F1TABLE 2

Mechanical power demand of steering pump

Identification of vehicle configuration					Steering power consumption P [W]														
Number of axles	Axle configuration	Chassis configuration	Technically permissible maximum laden mass (tons)	Vehicle group	Long haul			Regional delivery			Urban delivery			Municipal utility			Construction		
					U + F	B	S	U + F	B	S	U + F	B	S	U + F	B	S	U + F	B	S
2	4 × 2	Rigid lorry + (Tractor)	7,5 - 10	1				240	20	20	220	20	30						
		Rigid lorry + (Tractor)	10 - 12	2	340	30	0	290	30	20	260	20	30						
		Rigid lorry + (Tractor)	12 - 16	3				310	30	30	280	30	40						
		Rigid lorry	16	4	510	100	0	490	40	40	430	40	50	430	30	50	580	30	70
		Tractor	> 16	5	600	120	0	540	90	40							640	50	80
	4 × 4	Rigid lorry	7,5 - 16	6	—														
		Rigid lorry	16	7	—														
		Tractor	> 16	8	—														
3	6 × 2/2 – 4	Rigid lorry	all	9	600	120	0	490	60	40	440	50	50	430	30	50	640	50	80
		Tractor	all	10	450	120	0	440	90	40							640	50	80

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	6 × 4	Rigid lorry	all	11	600	120	0	490	60	40				430	30	50	640	50	80
		Tractor	all	12	450	120	0	440	90	40							640	50	80
	6 × 6	Rigid lorry	all	13	—														
		Tractor	all	14															
4	8 × 2	Rigid lorry	all	15	—														
	8 × 4	Rigid lorry	all	16													640	50	80
	8 × 6/8 × 8	Rigid lorry	all	17	—														

Textual Amendments

F1 Substituted by Commission Regulation (EU) 2019/318 of 19 February 2019 amending Regulation (EU) 2017/2400 and Directive 2007/46/EC of the European Parliament and of the Council as regards the determination of the CO2 emissions and fuel consumption of heavy-duty vehicles (Text with EEA relevance).

where:

U = Unloaded – pumping oil without steering pressure demand
F = Friction – friction in the pump
B = Banking – steer correction due to banking of the road or side wind
S = Steering – steer pump power demand due to cornering and manoeuvring.]

To consider the effect of different technologies, technology depending scaling factors as shown in Table 3 and Table 4 shall be applied.

TABLE 3

Scaling factors depending on technology

	Factor c1 depending on technology		
Technology	$c_{1,U+F}$	$c_{1,B}$	$c_{1,S}$
Fixed displacement	1	1	1
Fixed displacement with electronical control	0,95	1	1
Dual displacement	0,85	0,85	0,85
Variable displacement, mech. controlled	0,75	0,75	0,75

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Variable displacement, elec. controlled	0,6	0,6	0,6
Electric	0	$1,5/\eta_{alt}$	$1/\eta_{alt}$

with η_{alt} = alternator efficiency = const. = 0,7

[[F1]If a new technology is not listed, the technology 'fixed displacement' shall be considered in the simulation tool.**]**

TABLE 4

Scaling factor depending on number of steered axles

	Factor c2 depending on number of steered axles														
Number of steered axles	**Long haul**			**Regional delivery**			**Urban delivery**			**Municipal utility**			**Construction**		
	$c_{2,U+F}$	**$c_{2,B}$**	**$c_{2,S}$**	**$c_{2,U+F}$**	**$c_{2,B}$**	**$c_{2,S}$**	**$c_{2,U+F}$**	**$c_{2,B}$**	**$c_{2,S}$**	**$c_{2,U+F}$**	**$c_{2,B}$**	**$c_{2,S}$**	**$c_{2,U+F}$**	**$c_{2,B}$**	**$c_{2,S}$**
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	0,7	0,7	1,0	0,7	0,7	1,0	0,7	0,7	1,0	0,7	0,7	1,0	0,7	0,7
3	1	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5
4	1,0	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5	1,0	0,5	0,5

The final power demand is calculated by:

If different technologies are used for multi-steered axles, the mean values of the corresponding factors c1 shall be used.

The final power demand is calculated by:

$P_{tot} = \Sigma_i(P_{U+F} * mean(c_{1,U+F}) * (c_{2i,U+F})) + \Sigma_i(P_B * mean(c_{1,B}) * (c_{2i,B})) + \Sigma_i(P_S * mean(c_{1,S}) * (c_{2i,S}))$

where:

P_{tot}	=	Total power demand [W]
P	=	Power demand [W]
c_1	=	Correction factor depending on technology
c_2	=	Correction factor depending on number of steered axles
$U+F$	=	Unloaded + friction [-]
B	=	Banking [-]
S	=	Steering [-]
i	=	Number of steered axles [-]

3.3 Electric system

For the electric system power the standard values [W] as shown in Table 5 shall be used depending on the application and technology in combination with the alternator efficiencies:

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TABLE 5

Electrical power demand of electric system

Technologies influencing electric power consumption	Electric power consumption [W]				
	Long haul	**Regional delivery**	**Urban delivery**	**Municipal utility**	**Construction**
Standard technology electric power [W]	1 200	1 000	1 000	1 000	1 000
LED main front headlights	– 50	– 50	– 50	– 50	– 50

To derive the mechanical power, an alternator technology dependent efficiency factor as shown in Table 6 shall be applied.

TABLE 6

Alternator efficiency factor

Alternator (power conversion) technologies Generic efficiency values for specific technologies	Efficiency η_{alt}				
	Long haul	**Regional delivery**	**Urban delivery**	**Municipal utility**	**Construction**
Standard alternator	0,7	0,7	0,7	0,7	0,7

[[F1]If the technology used in the vehicle is not listed, the technology ‘standard alternator’ shall be considered in the simulation tool.**]**

The final power demand is calculated by:

$$P_{tot} = \frac{P_{el}}{\eta_{alt}}$$

where:

P_{tot} = Total power demand [W]
P_{el} = Electrical power demand [W]
η_{alt} = Alternator efficiency [-]

3.4 Pneumatic system

For pneumatic systems working with over pressure the standard power values [W] as shown in Table 7 shall be used depending on application and technology.

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TABLE 7

Mechanical power demand of pneumatic systems (over pressure)

Size of air supply	**Technology**	**Long Haul**	**Regional Delivery**	**Urban Delivery**	**Municipal Utility**	**Construction**
		Pmean	**Pmean**	**Pmean**	**Pmean**	**Pmean**
		[W]	**[W]**	**[W]**	**[W]**	**[W]**
small displ. ≤ 250 cm^3 **1 cyl./2 cyl.**	Baseline	1 400	1 300	1 200	1 200	1 300
	+ ESS	– 500	– 500	– 400	– 400	– 500
	+ visco clutch	– 600	– 600	– 500	– 500	– 600
	+ mech. clutch	– 800	– 700	– 550	– 550	– 700
	+ AMS	– 400	– 400	– 300	– 300	– 400
medium 250 cm^3 < displ. ≤ 500 cm^3 **1 cyl./2 cyl. 1-stage**	Baseline	1 600	1 400	1 350	1 350	1 500
	+ ESS	– 600	– 500	– 450	– 450	– 600
	+ visco clutch	– 750	– 600	– 550	– 550	– 750
	+ mech. clutch	– 1 000	– 850	– 800	– 800	– 900
	+ AMS	– 400	– 200	– 200	– 200	– 400
medium 250 cm^3 < displ. ≤ 500 cm^3 **1 cyl./2 cyl. 2-stage**	Baseline	2 100	1 750	1 700	1 700	2 100
	+ ESS	– 1 000	– 700	– 700	– 700	– 1 100
	+ visco clutch	– 1 100	– 900	– 900	– 900	– 1 200
	+ mech. clutch	– 1 400	– 1 100	– 1 100	– 1 100	– 1 300
	+ AMS	– 400	– 200	– 200	– 200	– 500
large displ. > 500 cm^3 **1 cyl./2 cyl. 1-stage/2-stage**	Baseline	4 300	3 600	3 500	3 500	4 100
	+ ESS	– 2 700	– 2 300	– 2 300	– 2 300	– 2 600
	+ visco clutch	– 3 000	– 2 500	– 2 500	– 2 500	– 2 900
	+ mech. clutch	– 3 500	– 2 800	– 2 800	– 2 800	– 3 200
	+ AMS	– 500	– 300	– 200	– 200	– 500

For pneumatic systems working with vacuum (negative pressure) the standard power values [W] as shown in Table 8 shall be used.

TABLE 8

Mechanical power demand of pneumatic systems (vacuum pressure)

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	Long Haul	**Regional Delivery**	**Urban Delivery**	**Municipal Utility**	**Construction**
	Pmean	**Pmean**	**Pmean**	**Pmean**	**Pmean**
	[W]	**[W]**	**[W]**	**[W]**	**[W]**
Vacuum pump	190	160	130	130	130

Fuel saving technologies can be considered by subtracting the corresponding power demand from the power demand of the baseline compressor.

The following combinations of technologies are not considered:

(a) ESS and clutches

(b) Visco clutch and mechanical clutch

In case of a two-stage compressor, the displacement of the first stage shall be used to describe the size of the air compressor system

3.5 Air Conditioning system

For vehicles having an air conditioning system, the standard values [W] as shown in Table 9 shall be used depending on the application.

[F1 TABLE 9

Mechanical power demand of AC system

Identification of vehicle configuration					**AC power consumption [W]**				
Number of axles	**Axle configuration**	**Chassis configuration**	**Technically permissible maximum laden mass (tons)**	**Vehicle group**	**Long haul**	**Regional delivery**	**Urban delivery**	**Municipal utility**	**Construction**
2	4 × 2	Rigid lorry + (Tractor)	> 7,5 - 10	1		150	150		
		Rigid lorry + (Tractor)	> 10 - 12	2	200	200	150		
		Rigid lorry + (Tractor)	> 12 - 16	3		200	150		
		Rigid lorry	> 16	4	350	200	150	300	200
		Tractor	> 16	5	350	200			200
	4 × 4	Rigid lorry	> 7,5 - 16	6	—				

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		Rigid lorry	> 16	7	—				
		Tractor	> 16	8	—				
3	6 × 2/2 – 4	Rigid lorry	all	9	350	200	150	300	200
		Tractor	all	10	350	200			200
	6 × 4	Rigid lorry	all	11	350	200		300	200
		Tractor	all	12	350	200			200
	6 × 6	Rigid lorry	all	13	—				
		Tractor	all	14					
4	8 × 2	Rigid lorry	all	15	—				
	8 × 4	Rigid lorry	all	16					200
	8 × 6/8 × 8	Rigid lorry	all	17	—]				

3.6 Transmission Power Take-Off (PTO)

For vehicles with PTO and/or PTO drive mechanism installed on the transmission, the power consumption shall be considered by determined standard values. The corresponding standard values represent these power losses in usual drive mode when the PTO is switched off/ disengaged. **[**[F1]Application related power consumptions at engaged PTO are added by the simulation tool and are not described in the following.**]**

TABLE 10

Mechanical power demand of switched off/disengaged power take-off

Design variants regarding power losses (in comparison to a transmission without PTO and / or PTO drive mechanism)			
Additional drag loss relevant parts		**PTO incl. drive mechanism**	**only PTO drive mechanism**
Shafts / gear wheels	**Other elements**	**Power loss [W]**	**Power loss [W]**
only one engaged gearwheel positioned above the specified oil level (no additional gearmesh)	—	—	0
only the drive shaft of the PTO	tooth clutch (incl. synchroniser) or sliding gearwheel	50	50

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only the drive shaft of the PTO	multi-disc clutch	1 000	1 000
only the drive shaft of the PTO	multi-disc clutch and oil pump	2 000	2 000
drive shaft and/or up to 2 engaged gearwheels	tooth clutch (incl. synchroniser) or sliding gearwheel	300	300
drive shaft and/or up to 2 engaged gearwheels	multi-disc clutch	1 500	1 500
drive shaft and/or up to 2 engaged gearwheels	multi-disc clutch and oil pump	3 000	3 000
drive shaft and/or more than 2 engaged gearwheels	tooth clutch (incl. synchroniser) or sliding gearwheel	600	600
drive shaft and/or more than 2 engaged gearwheels	multi-disc clutch	2 000	2 000
drive shaft and/or more than 2 engaged gearwheels	multi-disc clutch and oil pump	4 000	4 000

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