

Technical Supplement for Non-Road Equipment

Texas Commission on Environmental Quality (TCEQ)

Texas Emissions Reduction Plan (TERP)

Texas Hydrogen Infrastructure, Vehicle, and Equipment (THIVE)
Grant Program



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Summary

This technical supplement contains instructions and inputs to calculate nitrogen oxides (NO_x) reductions for qualifying activities under the Texas Commission on Environmental Quality (TCEQ) Texas Emissions Reduction Plan (TERP), Texas Hydrogen Infrastructure, Vehicle, and Equipment (THIVE) Grant Program. The project categories may include replacement, repower, retrofit, and new purchase. Please refer to the current Request for Grant Applications (RFGA) for a definitive list of eligible project categories.

Non-road equipment that is 25 horsepower (hp) or greater is eligible for grants under this program for new purchases and leases, replacement, repower, and retrofit/add-ons. Most of the non-road engines eligible under this program will be powered by diesel-fueled compression-ignition (CI) engines. However, engines powered by other fuels may also be eligible, subject to decisions by TCEQ.

There is a worksheet provided at the end of this supplement that may be used to calculate the NO_x emissions reductions and the cost-effectiveness of the activities proposed in an application. TCEQ also provides a web-based calculator that may be used for the calculations. The calculator and information about the grant application process will be available on the TERP website at www.terpgrants.org.

Before beginning the calculation steps, review the conversion information below to understand units of measurement that will be used in this technical supplement.

Energy Measurement and Conversion

Non-road engine power can be measured in either horsepower (hp) or kilowatts (kW). For consistency purposes, calculations for NO_x reductions use horsepower.

To convert kW into horsepower, multiply the kW by 1.341.

$$1 \text{ kW} = 1.341 \text{ hp}$$

$$1 \text{ hp} = 0.746 \text{ kW}$$

Example: Convert to hp an engine that has a maximum continuous rated (MRC) power of 450 kW.

$$450 \text{ kW} \times 1.341 \text{ hp/kW} = 603.5 \text{ hp}$$

Engine emission standards may also be converted by using these factors:

$$1 \text{ g/kWh} = 0.746 \text{ g/hp-hr}$$

$$1 \text{ g/hp-hr} = 1.341 \text{ g/kWh}$$

Example: Convert the emissions standard of an engine listed as 10.5 g/kWh to g/hp-hr.

$$10.5 \text{ g/kWh} \times 0.746 = 7.8 \text{ g/hp-hr}$$

Instructions

This technical supplement is divided into three major steps.

Step 1: Determining that the activity meets the 25% NO_x emissions reduction requirement using baseline (old) and reduced (new) emissions standards.

Step 2: Calculating the NO_x Emission Reductions.

Step 3: Calculating the Cost Per Ton.

These steps are explained in the following instructions. Applicants may use the worksheet found at the end of this technical supplement to compute the emissions reductions and cost per ton for their application. Applicants may instead use the available web-based calculator available at www.terpgrants.org which will also refer to this technical supplement.

Step 1: Determine if the activity meets the 25% NO_x emissions reduction requirement.

All repower, retrofit, and add-on activities must achieve at least a 25% reduction in NO_x emissions when compared to a baseline emission rate.

Baseline NO_x Emission Rate

To determine the default baseline NO_x emission rate for most non-road and stationary engines, first determine the power (e.g., horsepower) and model year of the engine. If the engine is 2003 or older and does not comply with any other Environmental Protection Agency (EPA) or CARB emission standards, use Appendix A to determine the default emission rate for that engine.

For engines that are model year 2003 or newer, TCEQ will use the engine family code (EFC) of that engine to confirm the emission standard applicable to that engine. This is a 12-digit code that should be printed on the engine plate or be available via the engine manufacturer. Applicants may verify the emission standard of an engine by looking this code up on the [EPA's website](http://www.epa.gov). Most engines will have an emission standard that matches the Tier 2, 3 or 4 standards in Appendix A. Please be aware that some engines may have a Family Emission Limit (FEL) which may be different than the standard emission rate. If an engine has an FEL, TCEQ will use that value as it is the emission standard applicable to that engine.

Some stationary engines may have emission rates authorized by permit or other federal, state, or local regulations. In these instances, please utilize the average NO_x emissions from that engine for at least 2 consecutive years out of the last 10 years for that engine in tons per year. If this data is not available, please contact TERP for assistance in determining a baseline emission rate.

Determine the Reduced NO_x Emission Standard

The reduced NO_x emission standard will normally be the certified or verified emissions of the new reduced-emission engine.

Replacement and Repower. Use the certified emission standard (g/bhp-hr) of the replacement engine. In most cases, an applicant should use the current NO_x emission

standard for that model year and category of engine. However, if the new engine is certain to be certified to a lower emissions standard (e.g., the engine will have an FEL), an applicant may use that rate, subject to approval by TCEQ. Certified means certified by the EPA or CARB, or otherwise accepted by TCEQ.

Retrofit/Add-on. Use the verified or certified emission rate (g/bhp-hr) or emission reduction percentage for the retrofit or add-on device. The emission reductions must be certified or verified by the EPA or CARB, or otherwise accepted by TCEQ.

Calculate the Percentage NO_x Emission Reductions

Utilizing the baseline NO_x emission standard and the reduced NO_x emission standard identified above, use the equation provided below to calculate the percentage reduction in NO_x emissions. Remember, this value must be 25% or greater.

$$[(\text{Baseline NO}_x \text{ emission standard} - \text{Reduced NO}_x \text{ emission standard}) / \text{Baseline NO}_x \text{ emission standard}] \times 100 = \text{Percentage Reduction in NO}_x \text{ Emissions}$$

Step 2: Calculate the NO_x Emission Reductions

This step is divided into three main parts:

- Part A:** Determine the TxLED Correction Factor
- Part B:** Convert the emission rates to grams per hour (g/hr) and apply the TxLED correction factor (where appropriate)
- Part C:** Calculate the NO_x emission reductions

Part A: Determine the TxLED Correction Factor

TCEQ adopted rules (30 TAC 114.312 - 114.319) requiring that beginning on October 1, 2005, diesel fuel produced for use in compression-ignition engines in certain counties in Texas must meet new low emission diesel (TxLED) standards.

The counties affected by the new TxLED requirements currently include all of the counties eligible for TERP incentive funding, except for El Paso, Howard, and Hutchinson counties.

The TxLED requirements set a maximum aromatic hydrocarbon content standard of 10 percent by volume per gallon. The requirements also set a minimum cetane number for TxLED of 48.

The TxLED requirements are intended to result in reductions in NO_x emissions from diesel engines. Currently, a reduction factor of 5.7% (0.057) for on-road use and 7.0% (0.07) for non-road use and has been accepted as an estimate for use of TxLED. However, this reduction estimate is subject to change, based on the standards accepted by the EPA for use in the Texas State Implementation Plan (SIP).

For activities in the applicable counties, a correction factor of 0.93 will need to be applied when calculating the baseline and/or reduced emissions for diesel engines, regardless of when the grant-funded equipment began or will begin operation.

Part B: Convert the emission rates to grams per hour (g/hr) and apply the TxLED correction factor (where appropriate)

The NO_x emissions standards of heavy-duty engines are certified in grams per brake horsepower-hour (g/bhp-hr) or grams per kilowatt-hour (g/kW-hr). For performing these calculations, all emission standards must be in g/bhp-hr. Use the conversion factors provided in the Summary section of this document to convert emission standards that are in g/kW-hr to g/bhp-hr. If a standard was provided in NO_x+NMHC, use the following conversion factors to convert the standard to an estimated NO_x standard. Multiply the standard by 0.95 if it is for a diesel engine or 0.80 for any spark-ignition engine (e.g., propane, natural gas, gasoline).

To perform the emissions reduction calculations, the emissions standards in g/bhp-hr must be converted to grams per hour (g/hr). Multiply the emission standard of an engine by its power (in brake horsepower) to complete this conversion.

Next, if an engine is determined to have a TxLED factor in Part A, apply that factor to the converted emission standard.

For each engine, new and old, the following equation should be completed to ensure that an emission rate has been calculated for each of them.

$\text{Emission Rate (g/bhp-hr)} * \text{Engine Power (bhp)} * \text{TxLED factor} = \text{Emission Rate (g/hr)}$

Part C: Calculate the NO_x Emission Reductions

Calculating the NO_x emissions reductions requires some of the information that has been calculated or gathered in the previous steps plus some additional information. The following is needed to calculate the NO_x emissions reductions.

- The emissions factors calculated in Part B for the new and old engines in g/hr.
- The default annual hours for the old engines.
 - Use Appendix B to determine the default annual hours for an engine.
- The percentage of time in area that the applicant will commit to use the vessel and/or engines in the eligible areas (e.g., 75%, 90%).
 - This value must not be less than 55% and may be increased in increments of 10% up to a maximum of 95%. See the RFGA for more details regarding usage commitments.
- The load factor for the engines (see Appendix C).
- The length of the activity life of the project which is always 5 years for the THIVE program.
- A conversion factor to convert grams to tons which is 907,200 grams in a U.S. standard ton.

NO_x emissions reductions are calculated in tons and should be rounded to 4 decimal places at the end of the calculation, should rounding be needed. The formula for the NO_x emissions reduction calculation is shown below in Example #1. For stationary engines that already have their emissions rate in tons per year, please use Example #2.

THIVE is a competitive grant round and one of the factors utilized in the grant selection process is total NO_x emissions reductions. The higher the NO_x emissions reductions of the project, the more competitive the grant application may be.

Example #1

$(\text{Old engine emissions factor (g/hr)} * \text{load factor}) - (\text{new engine emissions factor (g/hr)} * \text{load factor}) = \text{reduced emissions factor (g/hr)}$

$\text{Reduced emissions factor (g/hr)} * \text{default annual hours (hr)} = \text{emissions per year (g/yr)}$

$\text{Emissions per year (g/yr)} * \text{usage in area (\%)} = \text{area emissions per year (g/yr)}$

$\text{Area emissions per year (g/yr)} \div \text{grams to tons factor (g/ton)} = \text{area emissions (tons/yr)}$

$\text{Area emissions (tons/yr)} * \text{activity life (yr)} = \text{Total NO}_x \text{ emissions reductions (tons)}$

Example #2

$\text{Old engine emissions factor (tons/yr)} - \text{new engine emissions factor (tons/yr)} = \text{reduced emissions factor (tons/yr)}$

$\text{Emissions per year (tons/yr)} * \text{usage in area (\%)} = \text{area emissions per year (tons/yr)}$

$\text{Area emissions per year (tons/yr)} * \text{activity life (yr)} = \text{Total NO}_x \text{ emissions reductions (tons)}$

Step 3. Calculate Cost Per Ton

The cost per ton for an activity is then determined by dividing the requested grant amount for that activity by the total NO_x emission reductions for that activity.

For multi-activity projects, the cost per ton of the complete project is determined by dividing the requested grant amount for the entire project by the total NO_x emission reductions for all of the activities included in that project.

$\text{Requested Grant Amount (\$)} / \text{Total NO}_x \text{ Emission Reductions (tons)}$

$= \text{Cost Per Ton of NO}_x \text{ Reduced (\$/tons)}$

Non-Road Engines Calculation Worksheet

This worksheet is provided to assist applicants in estimating the NO_x emissions reductions and cost per ton of NO_x reduced for each activity. See the Project Cost Per Ton and NO_x Emissions Reductions Worksheet to calculate these values for the entire project.

Activity Information

What is the default hours of usage for your engine (Appendix B)?	
What is the percent of usage in the eligible counties (Part C)?	
What is the incremental cost of the activity?	
What is the requested grant amount for the activity?	
Old Engine Information	
Model Year:	
Engine Power (hp):	
Emission Rate (g/bhp · hr) (Step 1):	
TxLED Factor (Part A): Note: Only if applicable	
Load Factor (Appendix C):	
New Engine Information	
Model Year:	
Engine Power (hp):	
Emission Rate (g/bhp · hr) (Step 1):	
TxLED Factor (Part A): Note: Only if applicable	
Load Factor (Appendix C):	
Check the Emissions Rate Reduction	
Old Engine Emission Standard (g/bhp · hr):	
- New Engine Emission Standard (g/bhp · hr):	
= Difference (g/bhp · hr):	
÷ Old Engine Emission Standard (g/bhp · hr):	
x:	100
= Emission Rate Reduction (%): Note: Must be 25% or more	

Determine Old Engine NO_x Emission Rate (g/mile)	
Old Engine NO _x Emission Rate (g/bhp · hr):	
x TxLED Correction Factor:	
x Load Factor:	
= Corrected NO _x Emission Rate (g/bhp · hr):	
x Engine Power (hp):	
= Converted Old Engine NO _x Emission Rate (g/hr):	
Determine New Engine NO_x Emission Rate (g/mile)	
New Engine NO _x Emission Rate (g/bhp · hr):	
x Load Factor:	
x TxLED Correction Factor:	
= Corrected NO _x Emission Rate (g/bhp · hr):	
x Engine Power (hp):	
= Converted New Engine NO _x Emission Factor (g/hr):	
Calculate the NO_x Emissions Reductions	
Converted Old Engine NO _x Emission Factor (g/hr):	
- Converted New Engine NO _x Emission Factor (g/hr):	
= Grams per Hour Reduced (g/hr):	
x Default Annual Hours (hr):	
x Percent within Eligible Counties (%):	
= Grams per Year Reduced (g/yr):	
÷ 907,200 Grams per Ton	907200
= Estimated Annual NO _x Emission Reduction (tons/yr):	
x Activity Life (years):	
= Estimated Activity Life NO _x Emission Reductions (tons):	
Requested Grant Amount (\$) ÷ NO _x Emission Reductions (tons) = Cost Per Ton (\$):	
Eligibility Checks	
Is the requested grant amount less than or equal to 100% of the incremental cost?	
Does the new engine reduce emissions by at least 25%?	

Project Cost Per Ton and NO_x Emissions Reductions Worksheet

This worksheet is provided to assist applicants in calculating their project NO_x emissions reductions and cost per ton.

Activity Number	NO _x Reductions	Requested Grant Amount
Activity 1		
Activity 2		
Activity 3		
Activity 4		
Activity 5		
Activity 6		
Activity 7		
Activity 8		
Activity 9		
Activity 10		
Total		

Total Requested Grant Amount	Math Function	Total NO _x Reductions	Math Function	Project Cost Per Ton
	÷		=	

Appendix A: Non-road engine emission standards

Non-Road Diesel Compression Ignition Engine NO_x Emission Standards by Model Year

Engine Power (hp): Equal to or greater than 25 hp (19 kW) but less than 50 hp (37 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1999	7.2	N/A
Tier 1	1999-2003	6.745	7.1
Tier 2	2004-2012	5.32	5.6
Tier 4	2013+	3.325	3.5

Engine Power (hp): Equal to or greater than 50 hp (37 kW) but less than 75 hp (56 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1998	8.8	N/A
Tier 1	1998-2003	6.9	N/A
Tier 2	2004-2007	5.32	5.6
Tier 3	2008-2013	3.325	3.5
Tier 4	2013+	3.325	3.5

Engine Power (hp): Equal to or greater than 75 hp (56 kW) but less than 100 hp (75 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1998	8.8	N/A
Tier 1	1998-2003	6.9	N/A
Tier 2	2004-2007	5.32	5.6
Tier 3	2008-2012	3.325	3.5
Tier 4 (Phase-In)	2012-2013	0.30-3.325 ¹	N/A
Tier 4	2014+	0.30	N/A

Engine Power (hp): Equal to or greater than 100 hp (75 kW) but less than 175 hp (130 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1997	9.5	N/A
Tier 1	1997-2002	6.9	N/A
Tier 2	2003-2006	4.655	4.9
Tier 3	2007-2011	2.85	3.0
Tier 4 (Phase-In)	2012-2013	0.30-2.85 ¹	N/A
Tier 4	2014+	0.30	N/A

Engine Power (hp): Equal to or greater than 175 hp (130 kW) but less than 300 hp (225 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1996	9.3	N/A
Tier 1	1996-2002	6.9	N/A
Tier 2	2003-2005	4.655	4.9
Tier 3	2006-2010	2.85	3.0
Tier 4 (Phase-In)	2011-2013	0.30-2.85 ¹	N/A
Tier 4	2014+	0.30	N/A

Engine power (hp): Equal to or greater than 300 hp (225 kW) but less than 600 hp (450 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1996	9.5	N/A
Tier 1	1996-2000	6.9	N/A
Tier 2	2001-2005	4.56	4.8
Tier 3	2006-2010	2.85	3.0
Tier 4 (Phase-In)	2011-2013	0.30-2.85 ¹	N/A
Tier 4	2014+	0.30	N/A

Engine power (hp): Equal to or greater than 600 hp (450 kW) but less than 750 hp (560 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-1996	9.7	N/A
Tier 1	1996-2001	6.9	N/A
Tier 2	2002-2005	4.56	4.8
Tier 3	2006-2010	2.85	3.0
Tier 4 (Phase-In)	2011-2013	0.30-2.85 ¹	N/A
Tier 4	2014+	0.30	N/A

Engine power (hp): Equal to or greater than 750 hp (560 kW)

Tier	Model Year	Emissions (NO _x) g/bhp-hr	Emissions (NO _x + NMHC) g/bhp-hr
Tier 0 (uncontrolled)	pre-2000	9.1	N/A
Tier 1	2000-2005	6.9	N/A
Tier 2	2006-2010	4.56	4.8
Tier 4 (Phase-In)	2011-2014	2.6/0.50 ²	N/A
Tier 4	2015+	2.6/0.50 ³	N/A

Note: For calculations use the NO_x g/bhp-hr column. NO_x + NMHC g/bhp-hr column is listed for reference only.

¹It is not guaranteed that engines produced during these years will be eligible to receive a grant because manufacturers were phasing in the current NO_x emission standard of 0.3 g/bhp-hr of NO_x during these years. Replacement and repower projects must result in a minimum 25% reduction in the NO_x emission standard to be eligible. This means an engine must have an emission rate of 0.40 g/bhp-hr or higher to qualify for a grant. Contact TERP if you are unsure if your engine is eligible to receive a grant.

²The 0.50 g/bhp-hr standard applies to gensets over 1200 hp.

³Applies to all gensets.

Appendix B: Default Hours or Standard Usage Rate(s) Diesel Engines

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2270001060	Specialty Vehicle Carts	Recreational Equipment	437
2270002003	Pavers	Construction and Mining Equipment	81
2270002006	Tampers/Rammers	Construction and Mining Equipment	462
2270002009	Plate Compactors	Construction and Mining Equipment	486
2270002015	Rollers	Construction and Mining Equipment	213
2270002018	Scrapers	Construction and Mining Equipment	732
2270002021	Paving Equipment	Construction and Mining Equipment	412
2270002024	Surfacing Equipment	Construction and Mining Equipment	566
2270002027	Signal Boards/Light Plants	Construction and Mining Equipment	521
2270002030	Trenchers	Construction and Mining Equipment	1171
2270002033	Bore/Drill Rigs	Construction and Mining Equipment	594
2270002036	Excavators	Construction and Mining Equipment	1200
2270002039	Concrete/Industrial Saws	Construction and Mining Equipment	444
2270002042	Cement & Mortar Mixers	Construction and Mining Equipment	271
2270002045	Cranes	Construction and Mining Equipment	1251
2270002048	Graders	Construction and Mining Equipment	1200
2270002051	Off-Highway Trucks	Construction and Mining Equipment	1417
2270002054	Crushing/Proc. Equipment	Construction and Mining Equipment	959
2270002057	Rough Terrain Forklifts	Construction and Mining Equipment	878
2270002060	Rubber Tire Loaders	Construction and Mining Equipment	1200

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2270002066	Tractors/Loaders/Backhoes	Construction and Mining Equipment	714
2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	399
2270002072	Skid Steer Loaders	Construction and Mining Equipment	780
2270002075	Off-Highway Tractors	Construction and Mining Equipment	858
2270002078	Dumpers/Tenders	Construction and Mining Equipment	568
2270002081	Other Construction Equipment	Construction and Mining Equipment	384
2270003010	Aerial Lifts	Industrial Equipment	385
2270003020	Forklifts	Industrial Equipment	1706
2270003030	Sweepers/Scrubbers	Industrial Equipment	1224
2270003040	Other General Industrial Equipment	Industrial Equipment	881
2270003050	Other Material Handling Equipment	Industrial Equipment	423
2270003060	AC\Refrigeration	Industrial Equipment	1347
2270003070	Terminal Tractors	Industrial Equipment	1261
NA	Container Handlers	Industrial Equipment	1200
2270004031	Leaf Blowers/Vacuums	Lawn and Garden Equipment (Com)	120
2270004046	Front Mowers	Lawn and Garden Equipment (Com)	482
2270004066	Chippers/Stump Grinders	Lawn and Garden Equipment (Com)	467
2270004071	Commercial Turf Equipment	Lawn and Garden Equipment (Com)	1072
2270004076	Other Lawn & Garden Equipment.	Lawn and Garden Equipment (Com)	435
2270005010	2-Wheel Tractors	Agricultural Equipment	1022
2270005015	Agricultural Tractors	Agricultural Equipment	600
2270005020	Combines	Agricultural Equipment	459

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2270005025	Balers	Agricultural Equipment	334
2270005030	Agricultural Mowers	Agricultural Equipment	363
2270005035	Sprayers	Agricultural Equipment	352
2270005040	Tillers > 6 HP	Agricultural Equipment	452
2270005045	Swathers	Agricultural Equipment	384
2270005055	Other Agricultural Equipment	Agricultural Equipment	765
2270005060	Irrigation Sets	Agricultural Equipment	1533
2270006005	Generator Sets	Commercial Equipment	339
2270006010	Pumps	Commercial Equipment	404
2270006015	Air Compressors	Commercial Equipment	818
2270006025	Welders	Commercial Equipment	645
2270006030	Pressure Washers	Commercial Equipment	145
2270006035	Hydro Power Units	Commercial Equipment	793
2270007015	Forest Equipment - Feller/Bunch/Skidder	Logging Equipment	1279
2270008005	Airport Support Equipment	Airport Ground Support Equipment	732

Natural Gas Engines

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2268002081	Other Construction Equipment	Construction and Mining Equipment	371
2268003020	Forklifts	Industrial Equipment	1800
2268003030	Sweepers/Scrubbers	Industrial Equipment	516
2268003040	Other General Industrial Equipment	Industrial Equipment	713
2268003060	AC\Refrigeration	Industrial Equipment	605

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2268003070	Terminal Tractors	Industrial Equipment	827
2268005055	Other Agricultural Equipment	Agricultural Equipment	403
2268005060	Irrigation Sets	Agricultural Equipment	2935
2268006005	Generator Sets	Commercial Equipment	115
2268006010	Pumps	Commercial Equipment	221
2268006015	Air Compressors	Commercial Equipment	484
2268006020	Gas Compressors	Commercial Equipment	6000
2268006035	Hydro Power Units	Commercial Equipment	450
2268008005	Airport Support Equipment	Airport Ground Support Equipment	681

Liquefied Petroleum (LPG) Engines

Source Classification Code (SCC)	Equipment Type	Classification	Annual Hours
2267001060	Specialty Vehicle Carts	Recreational Equipment	65
2267002003	Pavers	Construction and Mining Equipment	392
2267002015	Rollers	Construction and Mining Equipment	621
2267002021	Paving Equipment	Construction and Mining Equipment	175
2267002024	Surfacing Equipment	Construction and Mining Equipment	488
2267002030	Trenchers	Construction and Mining Equipment	402
2267002033	Bore/Drill Rigs	Construction and Mining Equipment	107
2267002039	Concrete/Industrial Saws	Construction and Mining Equipment	610
2267002045	Cranes	Construction and Mining Equipment	415
2267002054	Crushing/Proc. Equipment	Construction and Mining Equipment	241
2267002057	Rough Terrain Forklifts	Construction and Mining Equipment	413
2267002060	Rubber Tire Loaders	Construction and Mining Equipment	512
2267002066	Tractors/Loaders/Backhoes	Construction and Mining Equipment	870
2267002072	Skid Steer Loaders	Construction and Mining Equipment	310
2267002081	Other Construction Equipment	Construction and Mining Equipment	371
2267003010	Aerial Lifts	Industrial Equipment	361
2267003020	Forklifts	Industrial Equipment	1334
2267003030	Sweepers/Scrubbers	Industrial Equipment	516
2267003040	Other General Industrial Equipment	Industrial Equipment	713
2267003050	Other Material Handling Equipment	Industrial Equipment	386

SCC	Equipment Type	Classification	Annual Hours
2267003070	Terminal Tractors	Industrial Equipment	827
2267005055	Other Agricultural Equipment	Agricultural Equipment	403
2267005060	Irrigation Sets	Agricultural Equipment	2935
2267006005	Generator Sets	Commercial Equipment	115
2267006010	Pumps	Commercial Equipment	221
2267006015	Air Compressors	Commercial Equipment	484
2267006025	Welders	Commercial Equipment	408
2267006030	Pressure Washers	Commercial Equipment	115
2267006035	Hydro Power Units	Commercial Equipment	450
2267008005	Airport Support Equipment	Airport Ground Support Equipment	681

2-Stroke And 4-Stroke Engines (Gasoline)

Source Classification Code (SCC)	Equipment Type	Classification	2-Stroke or 4-Stroke	Annual Hours
2260001060	Specialty Vehicles/Carts	Recreational Equipment	2 Stroke	65
2260002006	Tampers/Rammers	Construction and Mining Equipment	2 Stroke	160
2260002009	Plate Compactors	Construction and Mining Equipment	2 Stroke	166
2260002021	Paving Equipment	Construction and Mining Equipment	2 Stroke	175
2260002027	Signal Boards/Light Plants	Construction and Mining Equipment	2 Stroke	318
2260002054	Crushing/Proc. Equipment	Construction and Mining Equipment	2 Stroke	241
2260003030	Sweepers/Scrubbers	Industrial Equipment	2 Stroke	516
2260003040	Other General Industrial Equipment	Industrial Equipment	2 Stroke	713
2260004025	Trimmers/Edgers/Brush Cutter	Lawn and Garden Equipment (Res)	2 Stroke	9

SCC	Equipment Type	Classification	2 Stroke or 4 Stroke	Annual Hours
2260004026	Trimmers/Edgers/ Brush Cutter	Lawn and Garden Equipment (Com)	2 Stroke	137
2260005035	Sprayers	Agricultural Equipment	2 Stroke	138
2260006005	Generator Sets	Commercial Equipment	2 Stroke	115
2260006010	Pumps	Commercial Equipment	2 Stroke	221
2260006015	Air Compressors	Commercial Equipment	2 Stroke	484
2260006035	Hydro Power Units	Commercial Equipment	2 Stroke	450
2260008005	Airport Support Equipment	Airport Ground Support Equipment	2 Stroke	681
2265001060	Specialty Vehicles/Carts	Recreational Equipment	4 Stroke	65
2265002003	Pavers	Construction and Mining Equipment	4 Stroke	392
2265002006	Tampers/Rammers	Construction and Mining Equipment	4 Stroke	160
2265002009	Plate Compactors	Construction and Mining Equipment	4 Stroke	166
2265002015	Rollers	Construction and Mining Equipment	4 Stroke	621
2265002021	Paving Equipment	Construction and Mining Equipment	4 Stroke	175
2265002024	Surfacing Equipment	Construction and Mining Equipment	4 Stroke	488
2265002027	Signal Boards/Light Plants	Construction and Mining Equipment	4 Stroke	318
2265002030	Trenchers	Construction and Mining Equipment	4 Stroke	402
2265002033	Bore/Drill Rigs	Construction and Mining Equipment	4 Stroke	107
2265002039	Concrete/Industrial Saws	Construction and Mining Equipment	4 Stroke	610
2265002042	Cement & Mortar Mixers	Construction and Mining Equipment	4 Stroke	84
2265002045	Cranes	Construction and Mining Equipment	4 Stroke	415

SCC	Equipment Type	Classification	2 Stroke or 4 Stroke	Annual Hours
2265002054	Crushing/Proc. Equipment	Construction and Mining Equipment	4 Stroke	241
2265002057	Rough Terrain Forklifts	Construction and Mining Equipment	4 Stroke	413
2265002060	Rubber Tire Loaders	Construction and Mining Equipment	4 Stroke	512
2265002066	Tractors/Loaders/Backhoes	Construction and Mining Equipment	4 Stroke	870
2265002072	Skid Steer Loaders	Construction and Mining Equipment	4 Stroke	310
2265002078	Dumpers/Tenders	Construction and Mining Equipment	4 Stroke	127
2265002081	Other Construction Equipment	Construction and Mining Equipment	4 Stroke	371
2265003010	Aerial Lifts	Industrial Equipment	4 Stroke	361
2265003020	Forklifts	Industrial Equipment	4 Stroke	1800
2265003030	Sweepers/Scrubbers	Industrial Equipment	4 Stroke	516
2265003040	Other General Industrial Equipment	Industrial Equipment	4 Stroke	713
2265003050	Other Material Handling Equipment	Industrial Equipment	4 Stroke	386
2265003060	AC\Refrigeration	Industrial Equipment	4 Stroke	605
2265003070	Terminal Tractors	Industrial Equipment	4 Stroke	827
2265004040	Rear Engine Riding Mowers	Lawn and Garden Equipment (Res)	4 Stroke	36
2265004041	Rear Engine Riding Mowers	Lawn and Garden Equipment (Com)	4 Stroke	569
2265004046	Front Mowers	Lawn and Garden Equipment (Com)	4 Stroke	86
2265004055	Lawn & Garden Tractors	Lawn and Garden Equipment (Res)	4 Stroke	45
2265004066	Chippers/Stump Grinders	Lawn and Garden Equipment (Com)	4 Stroke	488
2265004071	Commercial Turf Equipment	Lawn and Garden Equipment (Com)	4 Stroke	682
2265004075	Other Lawn & Garden Equipment	Lawn and Garden Equipment (Res)	4 Stroke	61
2265004076	Other Lawn & Garden Equipment	Lawn and Garden Equipment (Com)	4 Stroke	61

SCC	Equipment Type	Classification	2 Stroke or 4 Stroke	Annual Hours
2265005010	2-Wheel Tractors	Agricultural Equipment	4 Stroke	373
2265005015	Agricultural Tractors	Agricultural Equipment	4 Stroke	362
2265005020	Combines	Agricultural Equipment	4 Stroke	78
2265005025	Balers	Agricultural Equipment	4 Stroke	90
2265005030	Agricultural Mowers	Agricultural Equipment	4 Stroke	174
2265005035	Sprayers	Agricultural Equipment	4 Stroke	138
2265005040	Tillers > 6 HP	Agricultural Equipment	4 Stroke	29
2265005045	Swathers	Agricultural Equipment	4 Stroke	45
2265005055	Other Agricultural Equipment	Agricultural Equipment	4 Stroke	403
2265005060	Irrigation Sets	Agricultural Equipment	4 Stroke	2935
2265006005	Generator Sets	Commercial Equipment	4 Stroke	115
2265006010	Pumps	Commercial Equipment	4 Stroke	221
2265006015	Air Compressors	Commercial Equipment	4 Stroke	484
2265006025	Welders	Commercial Equipment	4 Stroke	408
2265006030	Pressure Washers	Commercial Equipment	4 Stroke	115
2265006035	Hydro Power Units	Commercial Equipment	4 Stroke	450
2265007010	Shredders > 6 HP	Logging Equipment	4 Stroke	50
2265007015	Forest Equipment - Feller/Bunch/Skidde	Logging Equipment	4 Stroke	350
2265008005	Airport Support Equipment	Airport Ground Support Equipment	4 Stroke	681

Appendix C: Load Factors for Non-Road Equipment

SCC Definition	HP MIN	HP MAX	Load Factor	ECF (gal/hp-hr)
Diesel Specialty Vehicle Carts	25	100	0.21	14.8
Diesel Specialty Vehicle Carts	100	1500	0.21	16.4
Diesel Pavers	25	100	0.59	17.2
Diesel Pavers	100	600	0.59	19.1
Diesel Rollers	25	100	0.59	17.2
Diesel Rollers	100	600	0.59	19.1
Diesel Scrapers	50	100	0.59	17.2
Diesel Scrapers	100	750	0.59	19.1
Diesel Paving Equipment	25	100	0.59	17.2
Diesel Paving Equipment	100	600	0.59	19.1
Diesel Surfacing Equipment	25	100	0.59	17.2
Diesel Surfacing Equipment	100	600	0.59	19.1
Diesel Signal Boards	25	100	0.43	17.4
Diesel Signal Boards	100	300	0.43	19.3
Diesel Trenchers	25	100	0.59	17.2
Diesel Trenchers	100	1500	0.59	19.1
Diesel Bore/Drill Rigs	25	100	0.43	17.4
Diesel Bore/Drill Rigs	100	1500	0.43	19.3
Diesel Excavators	25	100	0.59	17.2
Diesel Excavators	100	3000	0.59	19.1
Diesel Concrete/Industrial Saws	25	100	0.59	17.2
Diesel Concrete/Industrial Saws	100	175	0.59	19.1
Diesel Cement & Mortar Mixers	25	100	0.43	17.4
Diesel Cement & Mortar Mixers	100	750	0.43	19.3
Diesel Cranes	25	100	0.43	17.4
Diesel Cranes	100	1000	0.43	19.3
Diesel Graders	50	100	0.59	17.2
Diesel Graders	100	750	0.59	19.1
Diesel Off-highway Trucks	175	3000	0.59	19.1
Diesel Crushing/Proc. Equipment	25	100	0.43	17.4
Diesel Crushing/Proc. Equipment	100	750	0.43	19.3
Diesel Rough Terrain Forklifts	25	100	0.59	17.2

SCC Definition	HP MIN	HP MAX	Load Factor	ECF (gal/hp-hr)
Diesel Rough Terrain Forklifts	100	600	0.59	19.1
Diesel Rubber Tire Loaders	25	100	0.59	17.2
Diesel Rubber Tire Loaders	100	3000	0.59	19.1
Diesel Tractors/Loaders/Backhoes	25	100	0.21	14.8
Diesel Tractors/Loaders/Backhoes	100	300	0.21	16.4
Diesel Crawler Tractors	50	100	0.59	17.2
Diesel Crawler Tractors	100	1500	0.59	19.1
Diesel Skid Steer Loaders	25	100	0.21	14.8
Diesel Skid Steer Loaders	100	175	0.21	16.4
Diesel Off-Highway Tractors	175	3000	0.59	19.1
Diesel Dumpers/Tenders	25	100	0.21	14.8
Diesel Dumpers/Tenders	100	175	0.21	16.4
Diesel Other Construction Equipment	25	100	0.59	17.2
Diesel Other Construction Equipment	100	1000	0.59	19.1
Diesel Aerial Lifts	25	100	0.21	14.8
Diesel Aerial Lifts	100	175	0.21	16.4
Diesel Forklifts	40	100	0.59	17.2
Diesel Forklifts	100	600	0.59	19.1
Diesel Sweepers/Scrubbers	25	100	0.43	17.4
Diesel Sweepers/Scrubbers	100	300	0.43	19.3
Diesel Other General Industrial Equipment	25	100	0.43	17.4
Diesel Other General Industrial Equipment	100	750	0.43	19.3
Diesel Other Material Handling Equipment	40	100	0.21	14.8
Diesel Other Material Handling Equipment	100	600	0.21	16.4
Diesel AC\Refrigeration	25	100	0.43	17.4
Diesel Terminal Tractors	50	100	0.59	17.2
Diesel Terminal Tractors	100	600	0.59	19.1
Diesel Front Mowers (Commercial)	25	100	0.43	17.4
Diesel Lawn & Garden Tractors (Commercial)	40	100	0.43	17.4
Diesel Chippers/Stump Grinders (Commercial)	25	100	0.43	17.4

SCC Definition	HP MIN	HP MAX	Load Factor	ECF (gal/hp-hr)
Diesel Chippers/Stump Grinders (Commercial)	100	1000	0.43	19.3
Diesel Commercial Turf Equipment (Commercial)	25	100	0.43	17.4
Diesel Commercial Turf Equipment (Commercial)	100	600	0.43	19.3
Diesel Other Lawn & Garden Equipment (Commercial)	40	100	0.43	17.4
Diesel Other Lawn & Garden Equipment (Commercial)	100	175	0.43	19.3
Diesel Agricultural Tractors	25	100	0.59	17.2
Diesel Agricultural Tractors	100	750	0.59	19.1
Diesel Combines	50	100	0.59	17.2
Diesel Combines	100	600	0.59	19.1
Diesel Balers	40	100	0.59	17.2
Diesel Balers	100	300	0.59	19.1
Diesel Sprayers	25	100	0.59	17.2
Diesel Sprayers	100	600	0.59	19.1
Diesel Switchers	50	100	0.59	17.2
Diesel Switchers	100	175	0.59	19.1
Diesel Hydro Power Units	25	100	0.43	17.4
Diesel Hydro Power Units	100	600	0.43	19.3
Diesel Other Agricultural Equipment	25	100	0.59	17.2
Diesel Other Agricultural Equipment	100	600	0.59	19.1
Diesel Irrigation Sets	25	100	0.43	17.4
Diesel Irrigation Sets	100	600	0.43	19.3
Diesel Light Commercial Generator Sets	25	100	0.43	17.4
Diesel Light Commercial Generator Sets	100	600	0.43	19.3
Diesel Light Commercial Pumps	25	100	0.43	17.4
Diesel Light Commercial Pumps	100	600	0.43	19.3
Diesel Light Commercial Air Compressors	25	100	0.43	17.4
Diesel Light Commercial Air Compressors	100	600	0.43	19.3

SCC Definition	HP MIN	HP MAX	Load Factor	ECF (gal/hp-hr)
Diesel Light Commercial Gas Compressors	50	100	0.43	17.4
Diesel Light Commercial Welders	25	100	0.21	14.8
Diesel Light Commercial Welders	100	175	0.21	16.4
Diesel Light Commercial Pressure Washer	25	100	0.43	17.4
Diesel Light Commercial Pressure Washer	100	750	0.43	19.3
Diesel Logging Equip Fell/Bunch/Skidlers	25	100	0.59	17.2
Diesel Logging Equip Fell/Bunch/Skidlers	100	750	0.59	19.1
Diesel Airport Support Equipment	25	100	0.59	17.2
Diesel Airport Support Equipment	100	750	0.59	19.1
Diesel Other Oil Field Equipment	25	100	0.43	17.4
Diesel Other Oil Field Equipment	100	3000	0.43	19.3