

## Freedom 38 PPA™ – Engine-driven Plasma Cutting and Gouging System Acoustic Noise Level Measurements

Freedom 38 PPA™ engine-driven plasma cutting and gouging system integrated a 38 kW genset with a Deutz T4i diesel engine, Chicago Pneumatic air compressor and Powermax125® plasma system. Cutting or gouging with the Freedom 38 PPA™ can exceed acceptable noise levels as defined by local codes in many applications. Prolonged exposure to excessive noise will damage hearing. Always wear proper ear protection when cutting or gouging, unless sound pressure level measurements taken at the installed site have verified personal hearing protection is not necessary. See also “**Noise Can Damage Hearing**” in the *Safety & Compliance* manual.

Engine-driven plasma cutting and gouging systems, like Freedom 38 PPA™, have seven areas that create the majority of the high sound levels as shown in the following table.

Engine noise	This is mainly caused by mechanical and combustion forces.
Cooling fan noise	This results from the sound of air being moved at high speed across the engine and through the radiator.
Alternator noise	This is caused by cooling air and brush friction.
Induction noise	This is caused by fluctuations in current in the alternator windings that give rise to mechanical noise.
Engine exhaust noise	This is caused by a high intensity pressure wave generated by combustion in the engine cylinder propagates along the exhaust pipe and radiates from the exhaust pipe termination.
Structural/mechanical noise	This is caused by mechanical vibration of various structural parts and components that is radiated as sound.
Plasma cutting/gouging noise	This is caused by the plasma cutting or gouging processes.

### **Notes for End-Users:**

All relevant international, regional, national and local codes must be considered and adhered to as appropriate, in particular, if introducing the Freedom 38 PPA™ as part of a machine/mechanized solution in a job site.

If incorporating the Freedom 38 PPA™ as part of a mechanized cutting and gouging machine, a hierarchy of noise control should be adopted based primarily on elimination or control of noise ‘at source’ as part of the machine design in order to protect people who operate within the workplace or who may enter or stand near the workplace at any given time.

Metal cutting is noisy; using Freedom 38 PPA™ to cut metal is no exception. The noise measurements taken by Hypertherm are intended to provide a worst case indication of maximum potential sound pressure levels 1 meter from the plasma cutting torch head without the benefit of any noise controls in the design or operation of the Freedom 38 PPA™. The A-weighted sound pressure level was taken during a short duration of 1 minute of continuous cutting. Actual values measured in typical cutting or gouging applications for longer durations may be much lower. Shield the plasma cutting torch head and the engine exhaust pipe where practical. Significant engineering design improvements can be obtained by adding simple engineering controls to cutting tables such as barriers or curtains positioned between the plasma cutting torch head and the engine exhaust pipe to the workstation; and/or locating the workstation more than 1 meter away from the plasma cutting torch head and the engine exhaust pipe. Customers can also implement additional controls by installing reactive muffler. Reactive mufflers are the most common element used to silence generator exhausts. The noise is reduced by forcing the exhaust air to pass through a series of tubes and chambers. Each element in the muffler has sound reduction properties that vary greatly with acoustic frequency, and it is the mixing and matching of these elements that constitutes muffler design.

During customer site preparation for pipe or cutting table design, an assessment should be made to see whether the process or production set-up can be modified to reduce the noise levels. If the noise level is questionable, have a certified safety specialist or Industrial Hygienist take measurements and make recommendations. If engineering and administrative control methods fail to reduce noise to acceptable levels, in some countries local workplace regulations may require a Hearing Conservation Program (e.g. in the USA OSHA requires a Hearing Conservation Program if noise levels reach 85 dB on an 8-hour, Time Weighted Average (TWA) basis).

Use ear protectors if the noise is disruptive or if there is a risk of hearing damage after all other engineering and administrative controls have been implemented. If hearing protection is required, wear only approved personal protective devices such as ear muffs or ear plugs with a noise reduction rating appropriate for the situation. If the noise in your work area becomes uncomfortable, causing a headache or discomfort of the ears, you could be damaging your hearing and should immediately put on ear muffs or plugs.

For Genset-only measurement height was taken 23" from ground level. To load the Genset, output was set to produce 125A/150V (25.6A draw) into a resistive load bank. Process measurement was taken using cutting mode since this process produces more sound than does the gouging process.

### Sound Pressure measurements taken outside Hypertherm Research & Development Labs

#### Genset-only measurement

PRODUCT	Output current (typical or worse case)	Process	Measurement Distance From Source	peak C-weighted instantaneous sound pressure ( $L_{pCpeak}$ in dB) MaxP	A-weighted sound pressure ( $L_{pA}$ in dB) Lav5	Table Type and Water Level if Wet (workpiece above/below water)	Workpiece material & thickness	Date measurement taken
Freedom 38 PPA™	-	Ambient	Rear, 1 meter from Freedom 38 PPA™, 23" above ground	99.4	65.8	-	-	April 1, 2015
Freedom 38 PPA™	-	Idle		112.5	95.9	-	-	April 1, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		114.3	95.8	-	-	April 1, 2015
Freedom 38 PPA™	-	Idle	Rear, 2 meters from Freedom 38 PPA™, 23" above ground	110.6	93.8	-	-	April 1, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		112.3	94.1	-	-	April 1, 2015
Freedom 38 PPA™	-	Idle	Left side, 1 meter from Freedom 38 PPA™, 23" above ground	111.1	90.4	-	-	April 1, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		110.2	91.9	-	-	April 1, 2015
Freedom 38 PPA™	-	Idle	Left side, 2 meters from Freedom 38 PPA™, 23" above ground	110.6	90.2	-	-	April 1, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		110.3	91.7	-	-	April 1, 2015
Freedom 38 PPA™	-	Ambient	Engine side (right side), 1 meter from Freedom 38 PPA™, 23" above ground	98.4	63.1	-	-	April 14, 2015
Freedom 38 PPA™	-	Idle		113.1	94.5	-	-	April 14, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		115.1	94.1	-	-	April 14, 2015
Freedom 38 PPA™	-	Idle		108.8	91.1	-	-	April 14, 2015
Freedom 38 PPA™	125A @ 150V	Load bank		109.5	92.5	-	-	April 14, 2015

#### Plasma cutting process measurement

PRODUCT	Output current (typical or worse case)	Process	Measurement Distance From Source	peak C-weighted instantaneous sound pressure ( $L_{pCpeak}$ in dB) MaxP	A-weighted sound pressure ( $L_{pA}$ in dB) Lav5	Table Type and Water Level if Wet (workpiece above/below water)	Workpiece material & thickness	Date measurement taken
Freedom 38 PPA™	-	Ambient	Sound meter is 340mm (13 1/4") above the arc.	105.3	89.6	-	-	April 14, 2015
Freedom 38 PPA™	125A	Cutting, Air plasma/Air shield (75/75 psi), Drag Cutting, Maximum arc voltage 150 V	1 meter from front of arc 340mm (13 1/4") above the arc.	116.0	101.6	Steel was cut on a cart 0.82 meters above the ground	3/8" mild steel	April 14, 2015

Revision	Date	Section	History Change
1	Aug. 10, 2015	-	Initial Release