

NAP SILENTFLO



*Devil*

Industrial Silencers

**NAP SILENTFLO**  
THE EXPERTS IN NOISE CONTROL



# Devil

## Industrial Silencers

### Range of products

Five types of industrial silencers are detailed in this catalogue, classified as listed below:

- RAE medium degree straight through absorption type silencer.
- RIE or RIS multi-chamber reactive type silencers for industrial area applications.
- RRE or RRS multi-chamber reactive type silencers with higher performance for residential area applications.
- RR/AE or RR/AS multi-chamber silencers combining maximum reactive performance and absorption design for critical high performance requirements.
- SASE multi-chamber spark arrester silencers for applications where spark control is required.

The particular model and size is defined by the model and the inlet or outlet pipe nominal diameter. The above range indicates standard models but many other designs for special applications are available. Please enquire on the MRR, SAST, PD ranges and our numerous special designs.

### Construction

All silencers are constructed from heavy gauge hot rolled cold quenched sheet steel with all welded construction. Internal components are stiffened and braced to minimise resonances and vibration induced fatigue. Flanges are supplied to Table D or ANSI requirements. Threaded pipe ends are to BSP or metric threads. Drain plugs are fitted as standard for removal of condensate. All external surfaces are finished with high quality silicone based heat resistant aluminium paint which provides lasting protection at temperatures up to 600°C.

### Optional extras

- Matching flange kit, comprising two flanges, gaskets and two sets of nuts and bolts. (EK Kit.)
- Support brackets for vertical or horizontal installation.
- Designed to pressure vessel standards, AS1210, BS5500 or ASMEVIII.
- Flanged stainless steel expansion bellows.
- Tail pipes, transition pipes, ducting and flues.
- Construction in special steels.
- Surface treatment of blast clean, aluminium metal spray and epoxy sealer to BS2569 Part 2.
- Lifting hooks, mounting brackets or support legs on larger models.



## Special notes

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To maximise performance in critical situations the pipe between the silencer and the machine may need to be acoustically lagged to reduce breakout. Certain special designs such as for compressors require heavier construction, internal bracing, dished ends and full welding although the nominated dimensions may be complied with. We always recommend two stage silencing in super critical applications (ie. >40dB IL) with isolation between each stage in order to avoid flanking.

## Silencer Selection

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Once the attenuation requirement has been established the selection of a suitable silencer can be made from the application chart on page 7.

The correct silencer should meet the following, often conflicting, requirements:

- required attenuation
- physical size, including inlet and outlet flange size
- minimum back-pressure
- lowest cost

In selecting a silencer for a particular application it is generally sufficient to match inlet sizes although on diesel engines the exhaust silencer inlet flange is usually 50mm or more than the exhaust diameter. The back-pressure introduced by the installation of Devil Industrial silencers is negligible for absorption mufflers (RAE silencers) and only very rarely are problems encountered with reactive mufflers. (Silencers RIE, RRE, RR/AE and SASE).

Certain problems may occur when two silencers are installed in series. We do not recommend the use of two reactive silencers in series.

For clarification on the correct silencer for difficult applications contact your local 'NAP Silentflo' representative.

Other requirements that may influence silencer selection and design include:

- overall silencer length compared to the space available
- available installation positions
- heat radiation in closed spaces
- mixed flow environments
- cleaning and maintenance access
- vibration

## Installation Details

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In all cases the silencer, whether inlet or discharge, should be mounted as close to the engine or machine as practical.

Inlets and exhausts should be directed away from nearby noise sensitive areas to minimise directivity effects.

Exhaust silencers on diesel engines should be followed by a length of pipe equal to the silencer body length.

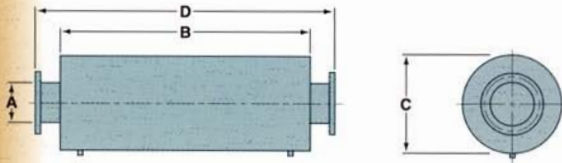
The distance from the exhaust manifold to the silencer should be as short as practical. Devil Industrial silencers will not perform correctly if installed back to front.

Always install the silencer with the gas flow in the direction indicated by the arrow on the silencer case. Vibration generated noise is a significant problem with many industrial applications and care should be taken to avoid rigid mounting of the silencer. Solidly mounted silencers can be fatigued by thermal expansion and continual vibration, resulting in internal collapse and failure of external fittings. For optimum silencer life the silencer should be isolated from the source of vibration by a flexible coupling and hung or supported by vibration isolated spring mounts.

Note also that the internal construction and design of special silencers particularly when used on compressors or blowers may not follow standard designs exactly. In some cases such items may even be designed as pressure vessels.

## RAE Absorptive Silencers

RAE or RAS absorption silencers are straight through types with side or end inlets and end outlets. Used in all applications where medium acoustic performance is required. The absorptive design also results in minimal pressure loss as the gas flows through the silencer bore.



### Application

Typical applications include intakes of petrol and diesel engines, intakes and discharges of rotary blowers, screw axial and reciprocating compressors, discharges of vacuum pumps, blowers and boiler flues.

### Details

Devil RAE industrial silencers are straight through absorptive silencers. The RAE model is for medium acoustical performance (10-15dB(A)). The insertion loss of these silencers varies according to the inlet diameter and is tabulated for easy reference. Noise is absorbed by long strand fibreglass retained and protected by the inner perforated steel tube. These silencers are used to control mid frequencies in the sound spectrum.

### Physical Dimensions

Size(A)	OD(C)	LOA(D)	LB(B)	Weight
50	150	925	825	5
75	200	1075	975	15
90	200	1075	975	18
100	225	1225	1125	27
125	225	1225	1125	35
150	380	1700	1500	60
200	450	1700	1500	80
250	550	2000	1800	115
300	650	2350	2100	180
400	800	3200	3000	295
500	1000	3700	3500	440

Notes: 1. Tolerance  $\pm 3\text{mm}$ . 2. Inlet dimensions are nominal pipe sizes only. 3. RAS silencers are available side entry, end exit or end entry and side exit. 4. Table D flanges are standard.

### Acoustic Performance

Inlet (mm)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
100	5	10	16	19	22	24	26	20
150	7	11	18	20	24	26	24	18
200	9	14	18	21	24	26	21	14
250	9	16	20	22	26	25	19	11
300	13	20	23	24	26	24	16	8

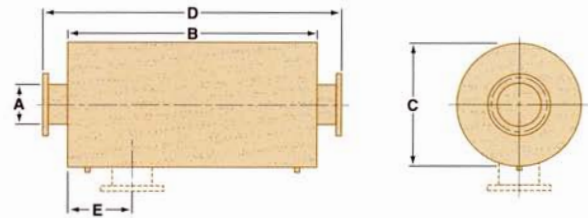
Note: Use IL values for 300mm at larger inlet diameters.

### Pressure Drop

The internal bore of the silencer is equal to the inlet diameter and consequently the gas flows through the silencer without restriction resulting in a pressure drop no greater than the equivalent length of straight pipe.

## RIE Silencers

RIE (End Inlet) and RIS (Side Inlet) silencers are multi-chamber reactive units for application where good broad band performance is required. These industrial grade silencers have a low pressure drop and are available with side or end entry or side inlet and outlet. They can be installed in any orientation without loss of acoustic performance.



### Application

These silencers are suitable for process plant noise control and for the exhaust of two or four stroke diesel engines when used as emergency power generators, pumping sets and mobile compressors. Their good low frequency performance enables these units to be used in most situations to provide reductions of approximately 20-25dB(A).

### Details

Devil RIE and RIS industrial silencers are dual chamber reactive type silencers tuned for medium performance. The RIE silencer has an overall performance of 20-25dB(A) for more stringent noise control requirements especially at low and mid frequencies. The silencers have low pressure drop for minimal resistance.

### Physical Dimensions

Size(A)	OD(C)	LOA(RIE)(D)	LB(B)	Offset(E)	Weight
100	350	810	660	230	30
125	400	960	810	230	50
150	450	1060	910	250	70
200	560	1400	1220	300	115
250	660	1470	1295	350	170
300	760	1700	1520	400	230
350	910	1880	1700	450	330
400	1020	2010	1830	500	500
450	1170	2340	2140	560	680
500	1270	2560	2360	610	775

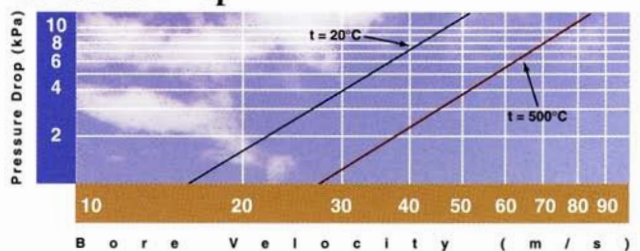
Notes: 1. Tolerance  $\pm 3\text{mm}$ . 2. Inlet dimensions are nominal pipe sizes only. 3. Overall length of RIS silencers is less than the overall length of RIE silencers. 4. Table D flanges are standard.

### Acoustic Performance

Inlet (mm)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
100	13	15	18	19	17	15	13	11
150	16	19	21	23	21	18	16	13
200	17	20	22	24	23	19	15	12
250	18	22	24	26	26	21	14	11
300	19	24	26	28	28	20	13	11

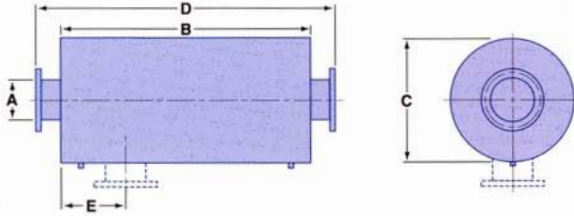
Note: Use IL values for 300mm at larger inlet diameters.

### Pressure Drop



## RRE Silencers

RRE (End Inlet) and RRS (Side Inlet) silencers are multi-chamber reactive units for applications where better than standard acoustic performance is required. These residential grade silencers have good pressure drop characteristics and are available with side or end entry or side inlet and outlet. They can be installed in any orientation without loss of acoustic performance.



### Application

These silencers can be used for noise control of two or four stroke diesel engines, the intake and discharge of rotary and reciprocating blowers, the intake and discharge of vacuum pumps and air compressors and for noise control of all gas handling systems. Designed for maximum all round performance, these silencers can provide overall reductions of 25-30dB(A) depending on the acoustic characteristics of the machine to be silenced.

### Details

Devil RRE silencers are dual chamber reactive acoustic filters with good low frequency performance. The RRE silencer, whether supplied with side or end entry, has a low pressure drop and can be used in most situations to provide reductions of approximately 25-30dB(A) across the entire frequency range.

### Physical Dimensions Dimension(mm) & Weight(kg)

Size(A)	OD(C)	LOA(RRE)(D)	LB(B)	Offset(E)	Weight
100	400	1290	1140	230	55
125	450	1550	1400	230	80
150	550	1675	1525	250	125
200	660	2005	1830	300	190
250	760	2515	2340	350	320
300	915	2920	2740	400	465
350	1020	3475	3250	450	640
400	1170	4035	3800	500	910
450	1270	4470	4200	840	1140
500	1450	4870	4600	900	1360

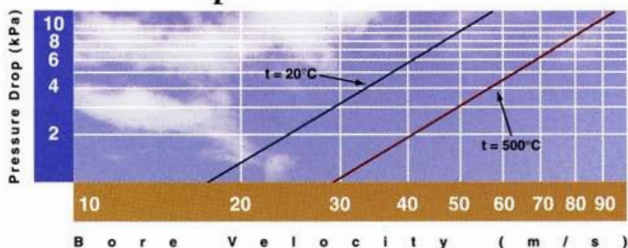
Notes: 1. Tolerance  $\pm 3$ mm. 2. Inlet dimensions are nominal pipe sizes only 3. Overall length of RRS silencers is less than the overall length of RRE silencers. 4. Table D flanges are standard.

### Acoustic Performance Insertion Loss (dB)

Inlet (mm)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
100	15	18	20	21	19	18	17	14
150	18	20	22	24	22	20	16	12
200	19	24	26	28	27	24	18	16
250	21	27	30	31	30	28	21	18
300	22	28	30	32	31	28	20	16

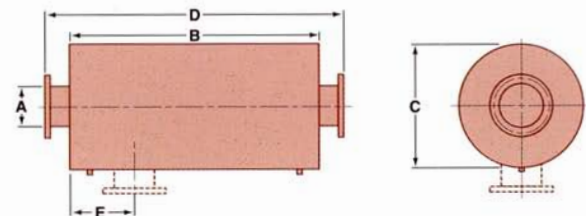
Note: Use IL values for 300mm at larger inlet diameters.

### Pressure Drop



## RR/AE Silencers

RR/AE (End Inlet/Entry) and RR/AS (Side Inlet/Entry) silencers provide the very highest noise control in all critical situations. These silencers have internal erosion resistant acoustic material for high performance broad band attenuation, protected by heavy duty perforated sheet. Multi-chamber reactive design combines with the absorption principle to provide the maximum performance at all frequencies.



### Application

As already stated, these units can be used for critical noise control of gas exhausts and air flows in all conditions. Please contact NAP Silentflo if you require higher performances ('super critical') in single or multiple arrangements.

### Details

Devil RR/AE silencers are multi-chambered reactive silencers with internal absorption to provide maximum broad band performance. These silencers are designed for maximum performance at low frequencies and can provide overall reductions of greater than 30dB(A) depending on the application and the pressure loss that can be tolerated.

### Physical Dimensions Dimension(mm) & Weight(kg)

Size(A)	OD(C)	LOA(RR/AE)(D)	LB(B)	Offset(E)	Weight
100	400	1290	1140	230	70
125	450	1550	1400	230	95
150	550	1675	1525	250	140
200	660	2005	1830	300	215
250	760	2515	2340	350	365
300	915	2920	2740	400	530
350	1020	3475	3250	450	715
400	1170	4035	3800	500	995
450	1270	4470	4200	840	1250
500	1450	4870	4600	900	1440

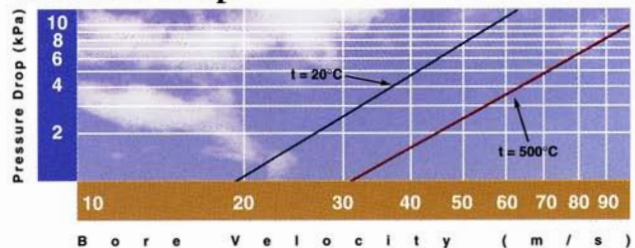
Notes: 1. Tolerance  $\pm 3$ mm. 2. Inlet dimensions are nominal pipe sizes only 3. Overall length of RRAS silencers is less than the overall length of RRAE silencers. 4. Table D flanges are standard.

### Acoustic Performance Insertion Loss (dB)

Inlet (mm)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
100	22	25	27	28	27	23	21	19
150	25	27	30	31	30	28	24	20
200	26	31	33	35	34	32	26	22
250	28	33	36	36	35	34	29	26
300	30	33	36	39	35	32	28	24

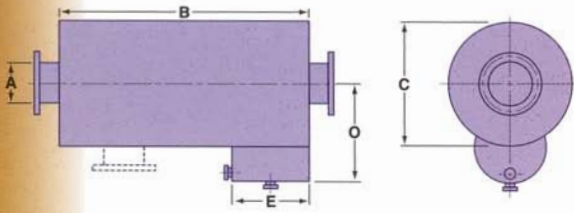
Note: Use IL values for 300mm at larger inlet diameters.

### Pressure Drop



## SASE Silencers

Devil SASE Spark Arrester silencers are multi-chamber reactive silencers, designed specifically for agricultural earthmoving or stationary equipment where control of particle fill exhaust gases is required. The spark arrester silencer includes carbon and ash traps which remove all sparks from the exhaust gas.



### Application

The SASE silencer is intended for use in outdoor areas where the potential fire risk of hot exhaust sparks cannot be tolerated. Devil Spark Arrester silencers are for use on engine driven compressors, mobile and stationary generating sets, two and four stroke petrol and diesel engines, in outdoor or remote installations.

### Details

The reactive multi-chamber design of the SASE silencer ensures reliable performance and long life under the most adverse conditions. The built in spark arrester section prevents the spread of dangerous ash and carbon particles. The ash collector has drain plugs for easy removal of waste deposits. The silencer complies to AS1019-1985 as does the Model SAST tractor silencer.

### Physical Dimensions Dimension(mm) & Weight(kg)

Size (A)	LOA (B)	OD (C)	Offset (O)	Chamber height (E)
50	530	220	150	150
75	660	300	230	180
90	760	350	280	200
100	810	350	280	230
125	960	400	300	250
150	1060	450	360	280
200	1400	560	410	300

Although not listed, 14 additional sizes are readily available.

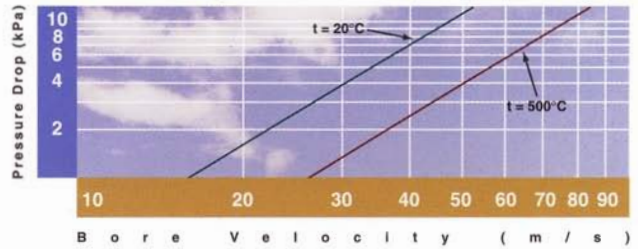
Notes: 1. Tolerance  $\pm 3\text{mm}$ . 2. Inlet dimensions are nominal pipe sizes only 3. Overall length of SASS silencers is less than the overall length of SASE silencers. 4. Table D flanges are standard.

### Acoustic Performance Insertion Loss (dB)

Inlet (mm)	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
50	14	16	18	20	18	15	13	10
100	15	18	20	21	19	15	13	11
150	18	20	22	24	22	20	16	12
200	19	24	26	28	29	24	18	16
250	21	28	30	31	30	28	20	18

Note: Use IL values for 250mm at larger inlet diameters.

### Pressure Drop



Exhaust silencers for Cummins diesel engines

## Silencer Selection

The first step in silencer selection is to establish the noise levels from the noisy machine. If noise measuring equipment is available, an octave band analysis is preferred but in all cases a dB(A) measurement is required. If a sound level meter is not available manufacturers can usually provide the unsilenced noise level of compressors, blowers, turbines, pumps or diesel engines.

### Acoustic Criterion

Once the machine noise level has been found the acoustic criterion must be established. For normal industrial working environments an acceptable criterion is NR85 or 90dB(A) at 1 metre but for commercial and occupied areas more strict criteria are often applied. A simplified method of setting a criterion is switching the noisy machine on and off, the difference in noise levels representing the required reduction. For a list of acceptable noise levels in community areas the reader is referred to AS1055-1989 'Noise Assessment in Residential Areas' and for internal areas AS2107-1987 'Ambient Sound Levels for areas of occupancy within buildings'.

In all circumstances one should take in to account shielding, directivity and distance attenuation in order to establish a suitable criterion. The use of a dB(A) criterion allows the silencer performance to be established by a single number but technically is less accurate.

### Example Silencer Performance

The difference between the unsilenced exhaust spectrum and the acceptable noise level criterion defines the minimum insertion loss that must be provided by the silencer. As an example a diesel engine is required to meet a criterion of NR75 due to the proximity of a nearby residential area. The attenuation required is given by following the procedure set out below.

Freq, Hz	125	250	500	1k	2k	4k	dB(A)
Lp*	105	98	92	90	88	82	96
Criterion NR75	87	82	77	75	73	70	81
IL	18	16	15	15	15	12	15

\*Unsilenced engine noise level at 1 metre.

The correct silencer for the given attenuation has the minimum performance defined in all octave bands, or alternatively an overall performance of 15dB(A).

### Silencer Selection Table

MACHINE	TYPE	LOCATION	RAE	RIE	RRE	RR/AE	SASE
Blowers	Centrifugal	Suction	✓	✓	✓	✓	
		Discharge	✓	✓		✓	
	Positive Displacement	Suction	✓			✓	
		Discharge	✓				
	Sliding Vane	Suction	✓			✓	
		Discharge	✓				
Compressors	Reciprocating	Suction		✓	✓	✓	
		Discharge	✓				
	Screw	Suction	✓			✓	
		Discharge	✓				
	Sliding Vane	Suction	✓			✓	
		Discharge	✓				
Engines Diesel & Petrol	Naturally Aspirated	Intake	✓	✓			
		Exhaust		✓	✓	✓	✓
	Turbo Charged	Intake	✓	✓			
		Exhaust		✓	✓	✓	✓
Turbines	Gas	Intake	✓				
		Exhaust	✓				
	Steam	Intake	✓				
		Exhaust	✓				
Vacuum Pumps	Centrifugal	Suction	✓				
		Discharge	✓			✓	
	Rotary	Suction	✓				
		Discharge		✓	✓	✓	
	Sliding Vane	Suction	✓				
		Discharge		✓	✓	✓	
Valves	Unloading Ejectors		✓				
Marine	Engines	Intake	✓				
		Exhaust			✓	✓	
Agricultural Earthmoving	Engine Powered	Intake	✓	✓			✓
		Exhaust	✓	✓	✓		✓

## Typical Specification

The equipment shall be provided with a suitably configured exhaust pipe and silencer. The silencer shall be selected, designed and fabricated to ensure compliance with the noise criteria specified.

The exhaust pipe may be manufactured from 1.6mm thick stainless steel Grade 304 or minimum 3mm mild steel piping. Mild steel flanges may be used. All exposed piping and silencers in noise sensitive areas shall be clad and acoustically insulated with flexible grade mineral wool insulation and metal cased (suitable for temperatures to 650°C if required). Insulation sections shall fit around the exhaust pipe and silencers neatly and accurately without gaps and shall be secured in a commercial and workmanlike manner. Loose insulation shall be sealed with Melinex only if SMF Conditions apply and for site work only.

Flanged sections of piping shall be insulated, but must be readily exposed to enable inspection or unbolting of joints. Gaskets must be used.

The exhaust silencer shall be of the reactive multi-chamber type, constructed of welded steel with internal absorption if required, designed for horizontal or vertical installation and

treated with high temperature paint in accordance with the specification. The silencer shall be factory built and delivered to site including matching Table D inlet and outlet flanges. The silencer shall be supplied to enable connection to the machine and the supporting structure via flexible coil spring vibration isolators and stainless steel bellows.

Silencer shall be a NAP Silentflo Model \_\_\_\_\_ with side entry and end exhaust to suit a flow of \_\_\_\_\_ m<sup>3</sup>/s at a temperature of 500°C. The silencer back pressure shall not exceed 2.5kPa. Total system pressure drop shall not exceed \_\_\_\_\_ kPa.

Silencer insertion loss shall be nominated in octave bands from 63 to 8000Hz and the manufacturer shall provide supporting documentation. Silencer manufacturer is to submit evidence demonstrating that the items can be manufactured in accordance with the requirements of AS3902. Manufacturer is to have a minimum of 5 years experience in the design and manufacture of silencer exhaust systems and to submit reference lists of customers, similar projects and equipment silenced.

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ABN 13 071 443 886

[www.nap.com.au](http://www.nap.com.au)

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### NAP Melbourne

303A/3 Chester St  
Oakleigh VIC 3166  
PH: +613 9530 9211  
FAX: +613 9530 9311

### NAP Sydney

2/1 Powdrill Rd  
Prestons NSW 2170  
PH: +612 9712 0722  
FAX: +612 9712 0822

Represented by: