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REFERENCE  
SS8/SS 1 0R/SS1 2R  
Subwoofers

INSTALLATION GUIDE

**SOUNDSTREAM**<sup>®</sup>

T E C H N O L O G I E S

SOUNDSTREAM TECHNOLOGIES

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**SOUNDSTREAM**<sup>®</sup>

T E C H N O L O G I E S

# REFERENCE SUBWOOFERS

## CONGRATULATIONS!

You have chosen a superior product for reproducing true high-fidelity in the car. This precision component, when properly installed, is capable of audiophile-quality performance. The REFERENCE woofers are well-suited for sealed, vented, and bandpass enclosures. They also work well in infinite baffle installations at one-half the power rating.

Should your woofer ever require service or replacement, recording the information below for your own records will help protect your investment.

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Dealer's Name: \_\_\_\_\_

Date of Purchase: \_\_\_\_\_

Installation Shop: \_\_\_\_\_

Installation Date: \_\_\_\_\_

## DESIGN FEATURES

- **Installation Flexibility** The REFERENCE woofers perform well in infinite baffle, sealed, vented, and bandpass enclosures. Regardless of the application, REFERENCE woofers perform.
- **Long Excursion Design** The REFERENCE woofers use high performance components to achieve extra long excursion for high output deep bass.
- **Massive Double Magnet Structure** for precise impact and deep bass.
- **Custom-designed High Strength Spider** controls the long travel cone assembly.
- **Custom-designed Cast Frame Basket** for deep excursion and precise alignment of the voice coil.
- **Computer Numerically Controlled** machined magnet plates precisely focus the magnet energy for optimum performance.
- **Designed and Manufactured in the U.S.A.**

## THIELE/SMALL PARAMETERS

	<b>SS-8</b>	<b>SS-1 OR</b>	<b>SS-1 2R</b>
Freq. Response	40-500 Hz	32- 500 Hz	33-500 Hz
Sens. 1w/1m	90 dB	90 dB	92 dB
Impedance (nom. z)	<b>4 ohms</b>	<b>4ohms</b>	<b>4ohms</b>
Rated Program Power	100 watts	200 watts	200 watts
Rated Peak Power	200 watts	<b>300watts</b>	<b>400watts</b>
Fs	40 Hz	35 Hz	35 Hz
Qts	0.370	<b>0.376</b>	<b>0.476</b>
Qms	2.16	<b>8.8</b>	<b>8.475</b>
Qes	0.450	<b>0.393</b>	<b>0.504</b>
Vas (ft <sup>3</sup> )	1.06	<b>1.80</b>	<b>4.00</b>
Vas (liters)	30	<b>51.0</b>	<b>113.3</b>
Vas (m <sup>3</sup> )	0.030	<b>0.051</b>	<b>0.113</b>
Cms (um/N)	416	<b>329.8</b>	<b>283</b>
DCR (ohms)	4.4	<b>3.36</b>	<b>3.74</b>
Levc (mH) @ 1 kHz	0.95	<b>1.05</b>	<b>1.332</b>
BL (Tesla m)	9.6	<b>10.75</b>	<b>10.897</b>
Sd (in <sup>2</sup> )	34.8	<b>54.3</b>	<b>86.7</b>
Sd (m <sup>2</sup> )	<b>0.0220</b>	<b>0.0350</b>	<b>0.0531</b>
Sd (cm <sup>2</sup> )	220	<b>350</b>	<b>531</b>
X max one way (linear mm)	7.00	6.6	7.5
X max one way (peak mm)	17	22	25
Vd (linear cm <sup>3</sup> )	157	231	398
Vd (peak cm <sup>3</sup> )	380	770	1325
Vd (linear m <sup>3</sup> )	<b>0.000157</b>	<b>0.000231</b>	<b>0.000398</b>
Vd (peak m <sup>3</sup> )	<b>0.000380</b>	<b>0.000770</b>	<b>0.001325</b>
Mms (grams)	37.6	60	68
Magnet Assembly (oz)	88	180	195
Magnet Weight (oz)	40	86	86
Vf (volume of frame)	<b>50in<sup>3</sup></b>	<b>180in<sup>3</sup></b>	200 in <sup>3</sup>
Coil (mm)	17	22.7	22.0
TP (mm)	8	9.5	9.5
Mounting Dia. (in)	7 1/4	9 1/4	11 1/4

## SELECTING AN ENCLOSURE

There are several different enclosure designs for different applications. The REFERENCE subwoofers work very well in all the following enclosure designs. It is up to you to select the specific enclosure that will work the best for your particular application.

### Infinite Baffle

Infinite baffle is the simplest type of subwoofer installation. In this type of installation, the woofer(s) is mounted to a baffle which is then mounted to either the rear deck or back seat of the vehicle. The best results are achieved when the trunk area is virtually airtight and isolated from the passenger compartment.

#### Pros

@Excellent low frequency extension  
\*Excellent transient response  
Uses almost no trunk space

#### Cons

● Lower power handling  
Low to medium efficiency

### Sealed Enclosure

Sealed enclosures are relatively simple to build and install, as all that is required is an airtight box. The larger the sealed enclosure, the more the performance resembles that of an infinite baffle installation. Small sealed enclosures work very well in midbass applications.

#### Pros

Very good low frequency extension  
Very good transient response

#### Cons

Medium power handling  
Medium efficiency



Sealed (S)

### Vented Enclosure

Vented enclosures use a sealed enclosure with a vent or port in the box which is tuned to resonate at a specific frequency.

#### Pros

Good low frequency extension down to the tuning frequency  
High power handling down to the tuning frequency  
Higher output than sealed enclosures

#### Cons

Low power handling below the tuning frequency  
Almost no output below the tuning frequency



Vented (V)

### Bandpass Enclosure

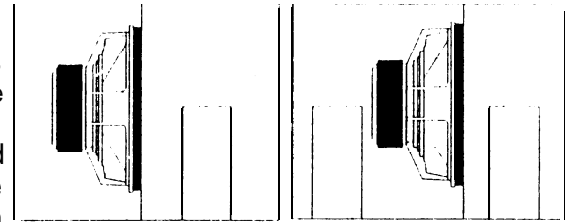
Bandpass enclosures enclose both sides of the woofer(s). An airtight enclosure is built around the front and back of the woofer and one or both chambers are ported to specific frequencies.

#### Pros

High power handling within the operating frequencies  
Very high output within the range of the operating frequencies

#### Cons

Low power handling beyond the tuning frequency  
Poor to moderate transient response  
Poor low frequency extension

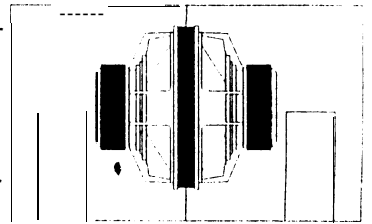


Sealed Bandpass (SW)

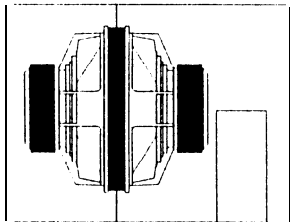
Vented Bandpass (VBP)

### Isobaric Woofer Configuration

There are two basic types of woofer configurations, standard and isobaric. The standard uses a single woofer and is the type used in most subwoofer installations. There are instances, however, when the airspace available for a subwoofer enclosure is not large enough to accommodate a particular design. In these instances, an Isobaric configuration (also known as push-pull, compound, clam-shell, and composite) may work. This configuration involves two woofers operating as one. The most common use of the Isobaric configuration is two woofers bolted together and the polarity is reversed on one of the woofers so that one pushes while the other pulls. The benefit of the Isobaric woofer configuration is that the  $V_{as}$  (equivalent airspace) of the woofer is halved. By the same token, the necessary airspace for the woofer to perform in an enclosure is cut in half. The disadvantages to the design, however, the main being that even though you are using two woofers, the output is equal to one woofer in an enclosure twice the size of the enclosure for the Isobarically configured woofer.



Isobaric Vented Bandpass (ISOVBP)

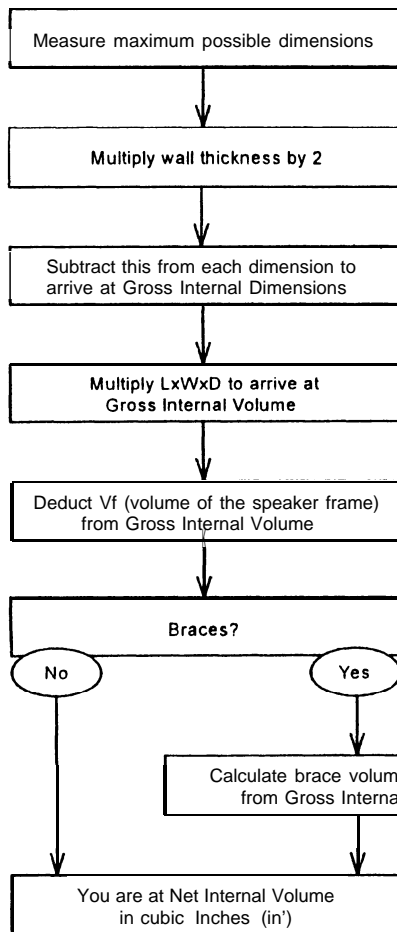


Isobaric Sealed Bandpass (ISOSBP)

### – CALCULATING (NET) INTERNAL ENCLOSURE VOLUMES –

When constructing any type of enclosure, you must be aware that the outside dimensions DO NOT represent the true (Net) volume inside. Such things as woofers, ports, thickness of enclosure material, dividing wall septums, and any internal bracing will reduce the total amount of the

actual air space available. The following worksheet has been designed to provide you with the necessary steps to accurately calculate the absolute (Net) internal volume of any given enclosure.

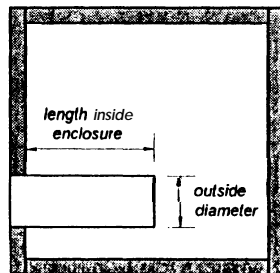


70 convert to LITERS:  
Divide in<sup>3</sup> by 61.03

70 convert to CUBIC FEET:  
Divide in<sup>3</sup> by 1728

### Calculating Cylindrical Port Volume

1. Measure the outside diameter of the port and divide by 2 for the radius.
2. Square the radius and multiply by 3.14 (x) to arrive at outside port area.
3. Multiply the area by the length of the port inside the enclosure for the port volume.



## BUILDING THE ENCLOSURE

- Determine the dimensions of your enclosure.
- Be certain the box you have designed will fit into the location you have chosen. Sometimes making a cardboard box with the same outside dimensions is helpful.
- Use 3/4 inch thick Medium Density Fiberboard (MDF) or High Density Particleboard. It is preferable to cut the wood with a table saw to ensure straight, even joints. If a table saw is not available, a circular saw is acceptable.
- Use a "T" square to verify precise right angle gluing.
- Use a high quality wood glue and air nails or wood screws to assemble the enclosure. Elmer's® woodworker's glue and Weldwood® work well. To guarantee an airtight box, seal each inside joint with RTV silicone glue.
- For Sealed Enclosures, stuff the chamber with 50-75% filling (approximately 1.5 pounds per cubic foot) of fiberglass insulation or Dacron.
- For Vented Enclosures, staple 1 inch thick fiberglass insulation or Dacron to all walls of the enclosure except the baffle to which the woofer is mounted.
- Use eight(8) wood screws or T-nuts and bolts to secure the woofer. Progressively tighten each of the bolts or screws to prevent warping the woofer frame.
- Use slide-on connectors to attach speaker wires (SS-8). Do not solder wires to the provided terminals as this may cause damage to the factory wire connection. This may also void the speaker's warranty.

## SUGGESTED ENCLOSURES

- The following designs include a variety of enclosure types. Each design has a frequency response curve that shows predicted output with 2.0 volts input, measured at 1 meter. 2.0 volts across a 4ohm load corresponds to 1 watt per speaker. Also, each frequency response curve was generated using a 12 dB/octave low pass filter at 100 Hz. The performance of each of these enclosures will be different once installed in a car. The amount each enclosure will vary depends on the car and installation location. The "standard" curves given correspond to performance outside the car to help you visualize relative performance differences. Read through the descriptions given for each enclosure and select the one that suits your needs.
- Remember: all suggested enclosure volumes are Net, and DO NOT include woofer, port, and bracing displacement!

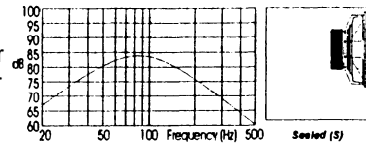
## REFERENCE SS8

### Infinite Baffle

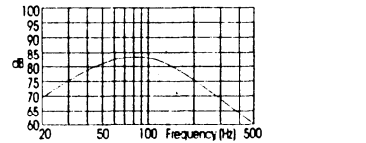
- Excellent performance for all types of music at moderate levels

### Sealed

- 0.5 ft<sup>3</sup> Net Internal Volume - Excellent for midbass, must be stuffed with fiberglass or other acoustic insulation

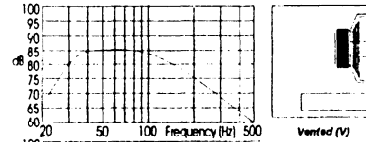


- 1.0 ft<sup>3</sup> - Good enclosure for classical & jazz

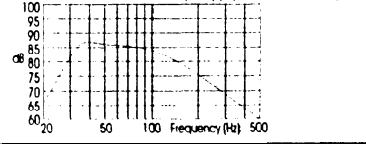


### Vented

- 0.75 ft<sup>3</sup> @ 35 Hz (3" x 14.5" port) - Very good for rock and rap

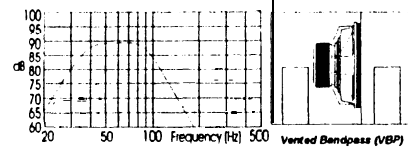


- 1.0 ft<sup>3</sup> @ 35 Hz (3" x 10.25" port) - Very good for jazz and rock, good for classical, good for rap



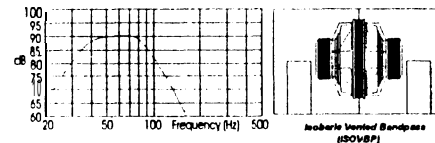
### Vented Bandpass

- Enclosure #19 - Very high output, smooth response, very good for rap & rock  
Rear = 0.86 ft<sup>3</sup> @ 37 Hz (3" x 10.75" port)  
Front = 0.39 ft<sup>3</sup> @ 70 Hz (3" x 5.75" port)



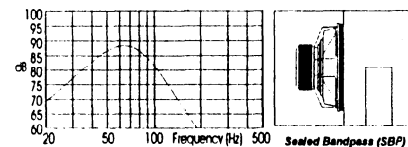
### Vented Bandpass - Isobaric Configuration

- Enclosure #19 - High output, wide response, punchy bass, good all around enclosure  
Rear = 0.45 ft<sup>3</sup> @ 35 Hz (3" x 26" port)  
Front = 0.2 ft<sup>3</sup> @ 70 Hz (3" x 13.5" port)



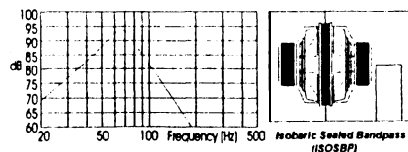
### Sealed Bandpass

- Enclosure #21 - Good output, good all around enclosure  
Rear = 0.64 ft<sup>3</sup> sealed  
Front = 0.4 ft<sup>3</sup> @ 65 Hz (4" x 13.25" port)



### Sealed Bandpass - Isobaric Configuration

- Enclosure #23 - Very high output, very good for rap or rock  
Rear = 0.35 ft<sup>3</sup> sealed  
Front = 0.4 ft<sup>3</sup> @ 65 Hz (4" x 33.25" port)



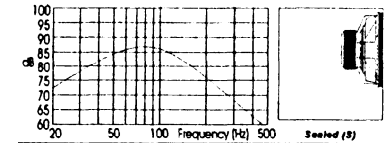
## REFERENCE SS10R

### Infinite Baffle

- Excellent performance for all types of music at moderate levels

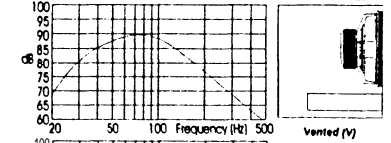
### Sealed

- 0.5 ft<sup>3</sup> to 1.5 ft<sup>3</sup> - Good all around enclosures, very good for classical and jazz, good for rock

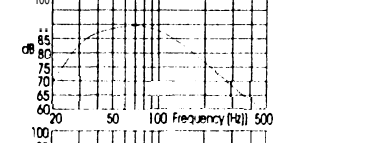


### Vented

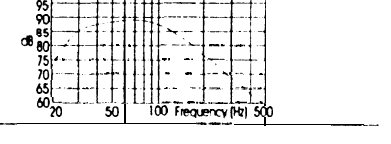
- 0.75 ft<sup>3</sup> @ 37 Hz (3" x 12.75" port) - Good small enclosure



- 1.0 ft<sup>3</sup> @ 35 Hz (3" x 10" port) - Very good all around enclosure

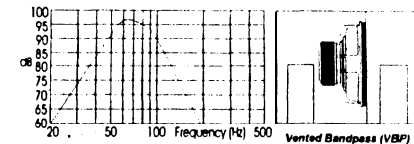


- 1.25 ft<sup>3</sup> @ 32 Hz (3" x 9.75" port) - Very good low frequency extension, very good for jazz and rock

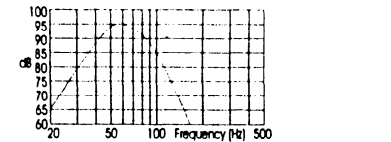


### Vented Bandpass

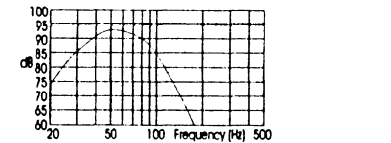
- Enclosure #34 - Super high output, very good for rap and rock  
Rear = 1.0 ft<sup>3</sup> @ 47 Hz (4" x 9.25" port)  
Front = 0.85 ft<sup>3</sup> @ 80 Hz (two 4" x 6.5" or three 4" x 10.75" ports)



- Enclosure #35 - High output, very good for rap and rock  
Rear = 1.1 ft<sup>3</sup> @ 39 Hz (4" x 13.5" port)  
Front = 0.73 ft<sup>3</sup> @ 73 Hz (two 4" x 10.5" ports)

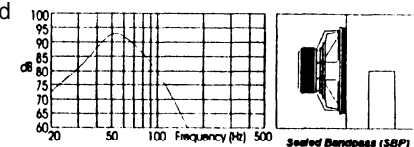


- Enclosure #36 - Good all-around enclosure  
Rear = 1.3 ft<sup>3</sup> @ 30 Hz (3" x 11" port)  
Front = 0.62 ft<sup>3</sup> @ 67 Hz (two 3" x 8.25" ports)



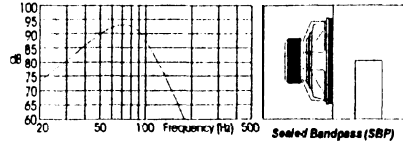
### Sealed Bandpass

- Enclosure #31 - Very high output, very good for rap  
Rear = 1.0 ft<sup>3</sup> sealed  
Front = 1.0 ft<sup>3</sup> @ 58 Hz (6" x 13.75" or two 4" x 12.75" or three 3" x 10" ports)

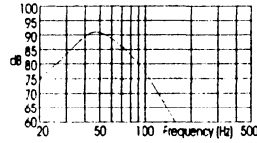


## REFERENCE SS10R (continued)

- Enclosure #32 - Very high output for rap or rock  
Rear = 1.2 ft<sup>3</sup> sealed  
Front = 0.7 ft<sup>3</sup> @ 75 Hz (two 4" x 10.75" ports)



- Enclosure #33 - Good output for all types of music  
Rear = 1.8 ft<sup>3</sup> sealed  
Front = 1.0 ft<sup>3</sup> @ 50 Hz (4" x 8" or two 3" x 9.5" ports)



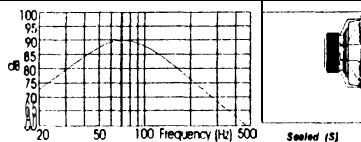
## REFERENCE SS1 2R

### Infinite Baffle

- Excellent performance for all types of music at moderate levels

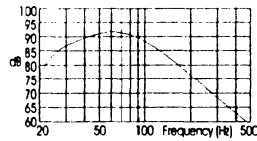
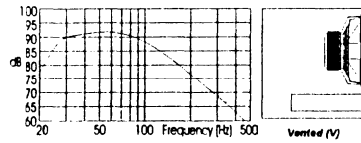
### Sealed

- 2.0 ft<sup>3</sup> - Good, smooth **butterworth** response (Q=.7), very good for jazz & classical, good for rock



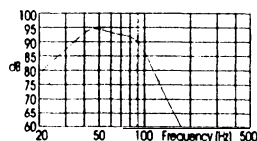
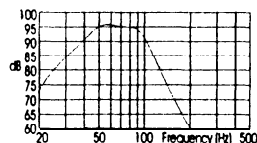
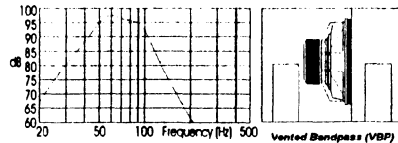
### Vented

- 4.3 ft<sup>3</sup> @ 30 Hz (two 4" x 11" ports) - Good for jazz & classical, very good for home use
- 3.0 ft<sup>3</sup> @ 30 Hz (4" x 7" port) - Good for rock, good all around enclosure



### Vented Bandpass

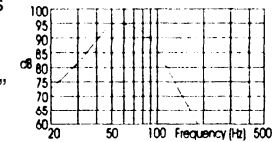
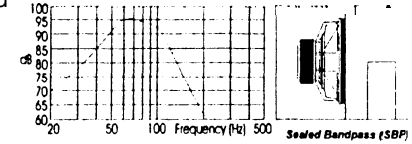
- Enclosure #40 - Super high output, good for rap or rock  
Rear = 2.2 ft<sup>3</sup> @ 41 Hz (two 4" x 11" ports)  
Front = 1.9 ft<sup>3</sup> @ 79 Hz (four 4" x 4.1" ports)
- Enclosure #41 - Very high output, good for rap or rock  
Rear = 2.4 ft<sup>3</sup> @ 33 Hz (4" x 7.4" port)  
Front = 1.7 ft<sup>3</sup> @ 72 Hz (three 4" x 4.2" ports)
- Enclosure #42 - High output, good for rap, rock or pop  
Rear = 3.0 ft<sup>3</sup> @ 28 Hz (4" x 8.6" port)  
Front = 1.4 ft<sup>3</sup> @ 67 Hz (four 4" x 11.5" ports)



## REFERENCE SS12R (continued)

### Sealed Bandpass

- Enclosure #37 - Very high output, very good for rap  
Rear = 1.0 ft<sup>3</sup> sealed  
Front = 1.5 ft<sup>3</sup> @ 78 Hz (two 6" x 7.4" or three 4" x 5" ports)
- Enclosure #38 - High output with good bass extension  
Rear = 1.5 ft<sup>3</sup> sealed  
Front = 2.0 ft<sup>3</sup> @ 65 Hz (8" x 6.5" or three 4" x 5.25" ports)



### Sealed Bandpass - Isobaric Configuration

- Enclosure #39 - Very high output with good bass extension  
Rear = 1.0 ft<sup>3</sup> sealed  
Front = 1.5 ft<sup>3</sup> @ 65 Hz (6" x 5" or two 6" x 13.5" or two 4" x 4.75" or three 4" x 8.75" ports)

