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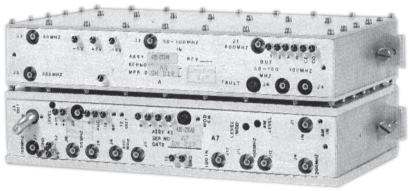
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FS2000 Series
Fast Switching Synthesizer





Supports hundreds of fast switching, high spectral purity applications.

Features:

- Ultra-fast Switching <1 µsec
- Wide and Narrow Band
- Exceptionally Clean
- An ideal source for: Simulators
  Radar
  RCS
  EW
  ATE Systems
  Subsystems

Description:

The FS-2000 family of frequency synthesizers operate in the frequency of 1 MHz to 18.4 GHz and offer submicrosecond frequency switching speed, and submicrosecond level correction, coupled with superb spectral purity. With an installed base supporting hundreds of submicrosecond switching and high spectral purity applications, the FS-2000 family are proven performers for a diverse range of stringent applications. Introduced in 1986, FS-2000 frequency synthesizers incorporate the most significant advances in frequency synthesizer technology and are based on Aeroflex's patented wideband direct analog synthesis techniques. The technology has been constantly refined and enhanced so that today the family comprises more than thirty models and a host of options which assure that your application has a reliable, proven, signal source.

Aeroflex's FS-2000 is the most significant advance in Frequency Synthesizer technology in over 10 years. It is the first synthesizer to combine ultra fast switching, low phase noise, and low spurious over a wide frequency range. Aeroflex's patented method achieves direct analog synthesis over an octave range. This combined with extensive hybridization enables the FS-2000 to be packaged in 1/3 the size of previous synthesizers. In addition, built-in fault isolation and modular construction reduce MTTR (Mean Time to Repair). Interchangeability and commonality of boards and modules minimize spare parts requirements. FS-2000 frequency synthesizers have uncompromising performance. Switching speed is specified simply; less than 1 usecond between any two frequencies with any resolution- no ifs, ands, or buts. Close-in spectral purity is virtually that of the frequency reference, multiplied to the output frequency, while far-out noise decreases monotonically to the floor. No phase-locked loops, no complicated schemes.

Just simple, direct and reliable. The FS-2000 is based on an iterative, modular direct analog architecture with a central reference generator that synthesizes 50, 100, 150, 200 and 800 MHz signals from a 100 MHz reference derived by multiplying a 5 or 10 MHz reference oscillator appropriately and improving far-out noise by judicious filtering. All frequencies are derived in an iterative frequency generation architecture. Frequencies are generated as a decade of frequency steps over an octave from 500 MHz inputs to the next stage.

Final outputs are produced by a scaling module which provides for doubling, dividing, or heterodyning to achieve a range of 10 MHz to 2.3 GHz. Units which have extended frequency ranges use an additional scaling module which doubles to 4.6 GHz, and again to 9.2 and 18.4 GHz. The architecture also provides the additional benefit of simplifying the user interface programming in Binary Coded Decimal (BCD). Naturally, a variety of interfaces are optionally provided, including IEEE-488 and a user friendly keyboard.

This unique, interactive, modular architecture also allows for easy configurations of OEM or specialized products.

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Revision Date: 8/21/2013

FS2000 Series
Fast Switching Synthesizer

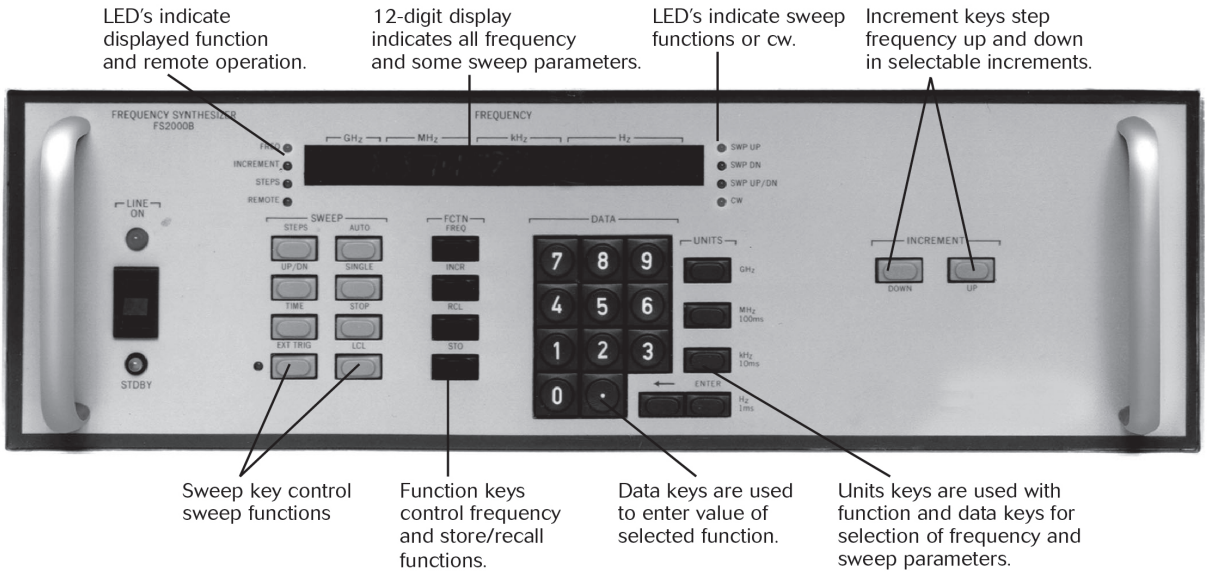
Best of Both Worlds

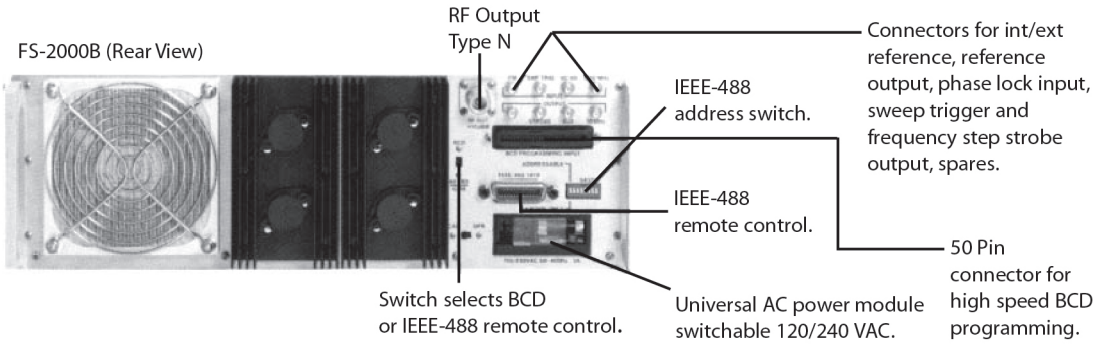
The FS-2000B and keyboard controlled units provide all the performance of the sub-microsecond System Synthesizer and easy to use, incredibly clean, bench synthesizers. The FS-2000B is like two synthesizers in one; a 1 usec switching computer controlled system synthesizer, and an IEEE-488 programmable keyboard entry bench synthesizer with extensive sweep and synchronization capability.

You can conveniently use the FS-2000 for system development with the convenience of keyboard entry of frequency increments and sweeps, as well as IEEE-488 FS-2000-18, FS-2000B-9, FS2000B-4, FS-2000B-2 programming.

With the flip of a switch, the FS-2000B becomes a BCD programmable 1 usec switching synthesizer. Even if you do not need fast switching, the FS-2000B-18 is one of the lowest phase noise 18 FHz synthesizers available.

The FS-2000 provides programmable and keyboard controlled modulation of AM and FM, and 1 usec frequency switching us to 4 GHz. The FS-2000C is also a pin-for-pin replacement for the Eaton/Ailtech 382/384M, with substantially improved performance and reliability.





Revision Date: 8/21/2013

FS2000 Series
Fast Switching Synthesizer

Selection Guide

0: Optional STD: Standard *3 - Standard 4/8 MMS module fits in 70001A main frame.

Frequency Range	Model FS-2000	Available Options					Standard Interface	Size"
		AM	FM	Pulse	Attenuation			
					Slow	Fast		
10 MHz to 2.3 GHz	A-2 B-2		0		0		BCD IEEE-488/BCD	2 2
10 MHz to 4.0 GHz	A-4 B-4		0 0		0	0	BCD IEEE-488/BCD	2 2
10 MHz to 9.2 GHz	A-9 B-9			0 0			BCD IEEE-488/BCD	2 2
10 MHz to 18.4 GHz	A-18 B-18 MMS-18	0	0	0 0	0		BCD IEEE-488/BCD MSIB/IEEE-488	2 2 3*

FS2000EW models incorporate wideband FM and FM active front panel indicator.

Refer to back page for complete list of Synthesizers and Options. **Refer to page 7 for complete outline drawings.

Options:

FM

Option 120 – wideband FM available for FS2000A/B

Frequency Range (MHz)	Peak Deviation Wide (MHz)	+/- MHz Narrow MHz
50-69	1.5	1/10 of wide
70-139	0.75	
140-279	1.5	
280-559	3.0	
560-1149	6.0	
1150-2299	12.0	
2300-4599	24.0	
4600-9199	48.0	
9200-18399	96.0	

Option 121 – Programmable FM; maintains constant deviation Available for FS2000A

Frequency Range (MHz)	Peak Deviation (MHz)
50-1149	0.01, 0.1, 1
1150-18399	0.1, 1, 10

Frequency Range: External
Source Only

Rate: DC: 0 to 5 MHz
AC: 50 Hz to 5 MHz

Option 122 – Pulse Modulation

On/off: 60 dB
Rise/Fall time: 40 nS

Option 125 – Fast Attenuator

Frequency Range: 0.5 to 18 GHz
Attenuation Range 0 to 60 dB
Attenuation Increments: 0.25 dB
Switching Time: 1 µS maximum

Option 128 – Slow Attenuator

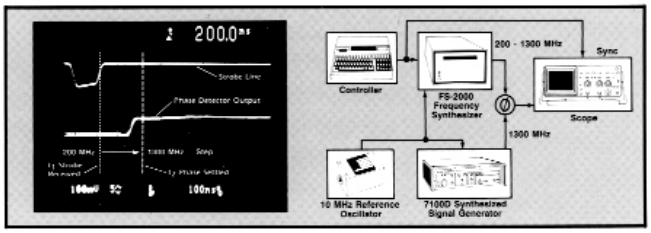
Frequency Range: 10 MHz-18.399 GHz
Attenuation Range: 0 to 120 dB
Attenuation Increments: 1 dB
Switching Time: 20 mS maximum

Contact the factory for non-standard options such as phase modulation or requirements not satisfied by standard options.

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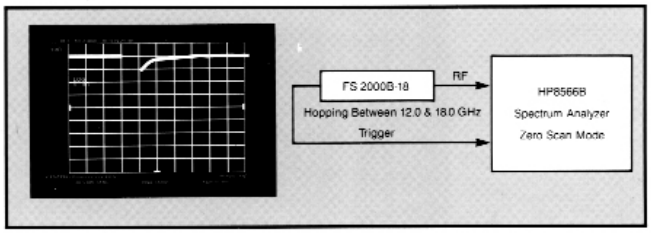
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SWITCHING SPEED: The FS-2000 switches between any two frequencies. 50 MHz-18.4 GHz in less than 1 msec. the switching time is measured: From the time the FS-2000 receives a strobe command to switch until the phase dector output shows arrival at new frequency. The FS-2000 is unique: the larger the step, the faster the switching speed: with 1 GHz steps and larger, typically switching in less than 250 nsec.



Actual photo showing 1100 MHz step in 200 nsec.

Frequency switching speed test set up

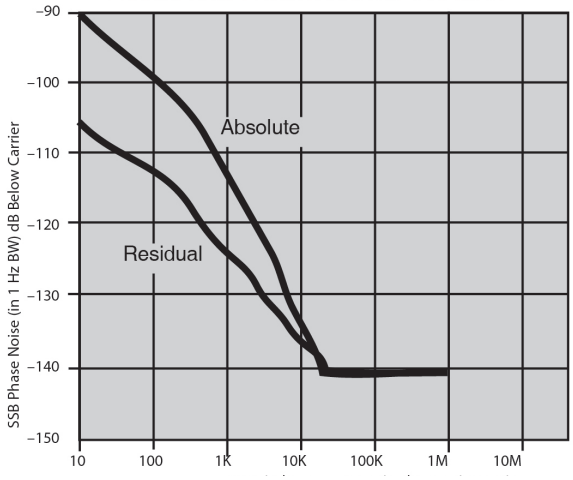


Amplitude settling time 12.0 to 18.0 GHz Frequency Step 1μ sec. within 1.0 dB, typical operation.

Amplitude settling time Test set up

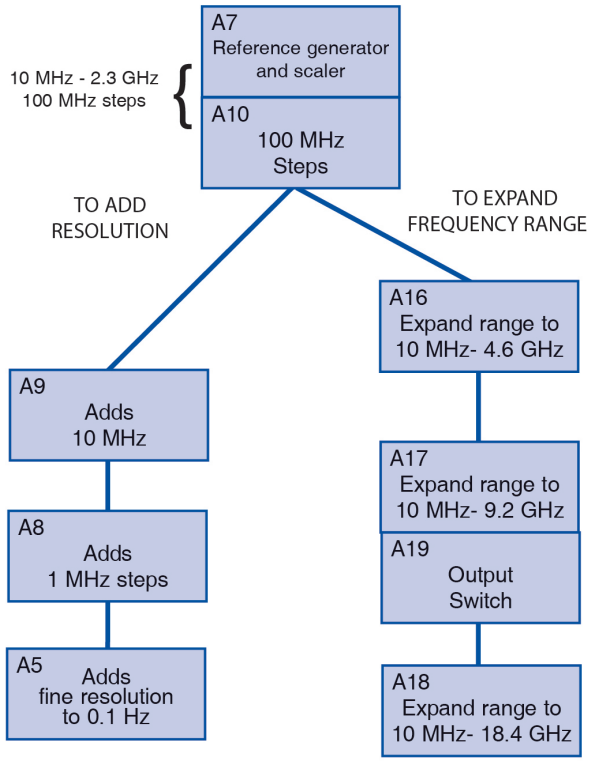
PHASE NOISE: The FS-2000 provides sub-microsecond switching and superior phase noise performance. The absolute phase noise curve below shows the actual output which includes the noise contribution of the internal 10 MHz Standard. The residual phase noise of the FS-2000 is also shown below. This indicates that if a lower noise external reference (5 MHz, 10 MHz or 100 MHz) is used, the phase noise theoretically can approach the residual phase noise of the FS-2000.

TYPICAL SSB PHASE NOISE @ 600 MHz



OEM CONFIGURATION GUIDE: Aeroflex's modular architecture and iterative frequency plan makes it ideally suited for Custom OEM applications. Just two standard modules make up a 50 MHz - 2.3 GHz, 100 MHz resolution OEM synthesizer with the same specifications as the standard family, needing only DC power and frequency reference. To obtain finer resolution and/or wider frequency coverage, just add the appropriate standard modules. Factory assistance is available to help you configure an OEM synthesizer which best meets your electrical or environmental specifications.

Modularity for Custom Configurations





Shock and vibration mounting available

FS2000 Series
Fast Switching Synthesizer

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Specifications

FREQUENCY:

Model	Range
FS-2000 A/B-2	50 MHz to 2300 MHz (2299,999999 MHz)
FS-2000 A/B-4	50 MHz to 4000 MHz (3999,999999 MHz)*
FS-2000 A/B-9	50 MHz to 9200 MHz (9199,999998 MHz)
FS-2000 A/B-18	50 MHz to 18400 MHz (18399,999996 MHz)

*Option 112 extends upper frequency to 4600 MHz (4599,999999 MHz)

Accuracy and Stability:

Same as Reference Oscillator

Reference Oscillator:

Internal: 10 MHz Quartz Oscillator Aging rate
5 x 10^{-9}/day after 24 hours (in normal operating environment)

External: Any 5 MHz or 10 MHz Frequency Standard at a level of 0 dBm + 2 dB

Frequency Switching Speed:

1 µsec maximum for any step size between any two frequencies.

Amplitude Settling Time

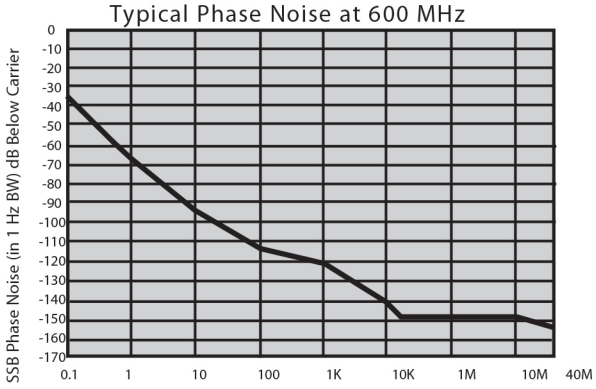
2 µsec maximum; to be within +2 dB of final amplitude.

Model	Resolution
FS-2000-2, -4:	1.0 Hz Standard 0.1 Hz Option 101
FS-2000-9:	2.0 Hz Standard 0.2 Hz Option 101
FS-2000-18:	4.0 Hz Standard 0.4 Hz Option 101

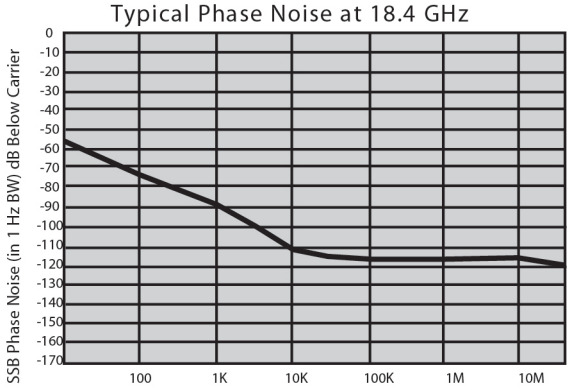
Spectral Purity: Absolute SSB Phase Noise in dBc/Hz (includes noise at internal reference)

Offset from Carrier	Carrier Frequency						
	100 MHz	600 MHz	1.2 GHz	2.4 GHz	4.6 GHz	9.2 GHz	18.4 GHz
10 Hz	100	85	79	73	67	61	55
100 Hz	113	98	92	86	80	74	68
1 kHz	128	113	107	101	95	89	83
20 kHz	145	138	132	126	122	116	110
100 kHz	147	140	134	128	122	116	110
10 MHz	147	140	134	128	122	116	110
40 MHz	147	140	134	128	122	116	110

Typical Phase Noise at 600 MHz



Typical Phase Noise at 18.4 GHz



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Specification (con't):

SPURIOUS SIGNALS:

	Frequency Range (MHz)			
	50 to 2300	2300 to 4600	4600 to 9200	9200 to 18000
Spurious Non-Harmonically Related	-70 dBc	-62 dBc	-56 dBc	-50 dBc
Sub-Harmonically Related† (f/2, 3f/2, etc)	-40 dBc	-40 dBc	-30 dBc	-30 dBc
Harmonics‡	-25 dBc*	-25 dBc	-25 dBc	-25 dBc

*560 to 800 MHz †Option 123: -55 dBc ‡FA 4000-1: -50 dBc

OUTPUT:

Level: +10 dBm

Leveling: ±2 dB (±5°C of Calibration Temperature)

Impedance: 50 Ω

REMOTE PROGRAMMING CONTROL INTERFACE:

INTERFACE:

Standard: **44 Bits Parallel BCD TTL Compatible; Positive True with Strobe. Mating Connector: 3M P/n 3564-1000**

B Chassis Only: **In addition to standard Interface: IEEE-488-1978: All functions controlled from the front panel, with the exception of the power line switch, are programmable with the same accuracy and resolution as in manual mode.**

C Chassis Only: **In addition to standard Interface: Modulation control interface; Pin-for-Pin replacement for EAton/Ailtech 382/382 M. Mating Connector: 3M P/N 3366-1000.**

DIGITAL SWEEP:

SWEEP MODES

Auto: Sweep repeats automatically

Single: Single sweep activated by front panel keyboard

SWEEP MODES:

Sweep Speed: Sweep repeats automatically 1 ms, 10 ms and 100 ms per step
External - Synchronized variable to 700 µsec per step

IN CONJUNCTION WITH ABOVE:

Sweep Up: Frequency sweeps from lower frequency to upper frequency, then return back to lower frequency.

Sweep Dn: Frequency sweeps from upper frequency to lower frequency, then return back to upper frequency.

Sweep Up/Dn: Frequency sweeps from lower frequency to upper frequency, then from upper
frequency to lower frequency.

No. of Steps: Selectable from 1 to 10,000 steps.

Step Size: Selectable, any size consistent with resolution of unit.

Stop Sweep: Causes internal sweet to halt immediately. Return control to command level.

GENERAL:

OPERATING Temperature Range: 0° to 50°C

Power Requirements: 120/250 VAC 48 to 440 Hz, 250 Watts

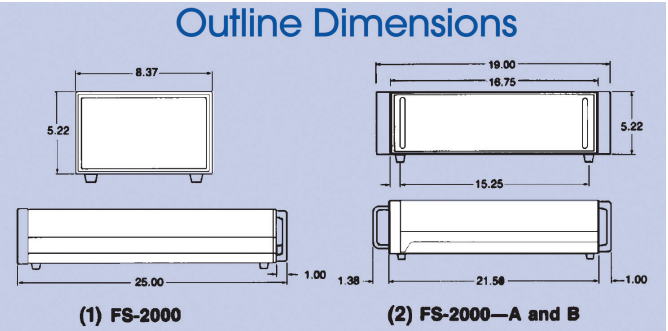
Physical Dimensions:

Weight

FS-2000: 46 lbs. (20.9 kg)
Fs-2000A, FS-2000B or FS-2000C: 50 lbs. (22.7 kg)

Dimensions

FS-2000: 8.37″ W x 5.22″ H x 25.0″
D (21.26 x 13.26 x 63.5 cm)
FS-2000A, FS-2000B or FS-2000C: 16.75″ x 5.22″ H x 23.88″
D (42.55 x 13.26.60.66 cm)



FS2000 Series
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Model Description:

FS-2000A-2	10 MHz to 2.3 GHz (1 MHz resolution)
FS-2000B-2	10 MHz to 2.3 GHz (1 Hz resolution) keyboard main frame (includes GPIB)
FS-2000A-4	10 MHz to 4.0 GHz (1 Hz resolution)
FS-2000B-4	10 MHz to 4.0 GHz (1 Hz resolution) keyboard main frame (includes GPIB)
FS-2000A-9	10 MHz to 9.2 GHz (2 Hz resolution)
FS-2000B-9	10 MHz to 9.2 GHz (2 Hz resolution) keyboard main frame (includes GPIB)
FS-2000A-18	10 MHz to 18.4 GHz (4 Hz resolution)
FS-2000B-18	10 MHz to 18.4 GHz (4 Hz resolution) keyboard main frame (includes GPIB)
FS-2000-MMS-18**	10 MHz to 18.4 GHz (0.4 Hz resolution) includes frequency modulation Output Level Control +10 to -110 dBm in 1 dB Steps: Two 4-Slot MMs modules

**MMs Does not include 70001A Main Frame

Options:

Model	Description
101	(Up to 4 GHz, 0.1 Hz resolution) (4.6 to 9.2 GHz, 0.2 Hz resolution) (9.2 to 18.4 GHz, 0.4 Hz resolution)
112	Extends upper frequency of -4 to 4.6 GHz
116	100 MHz reference
117	Reversed fan for increased air flow with filter
*120	Non-programmable wideband FM
*122	Pulse modulation 500 MHz to 4, 9, 18 GHz, 60 dB ON/OFF, 40 nsec R/F
*123	Low sub-harmonics at -66 dBC
125	Fast attenuator
126	High speed memory/HP 8510 interface (separate unit)
128	Slow attenuator
129	Differential BCD
904	Extra manual
905	Slides for full rack

* These options available in A and B chassis only.

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FS1200B Series
Fast Switching Synthesizer

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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