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Interface Practices Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 200 2022

**Specification for a 75 ohm 'MMCX' Connector (MMCX-75),
Male & Female Interface**

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140 Philips Road
Exton, PA 19341

Document Types and Tags

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1. Introduction

1.1. Executive Summary

This specification provides electrical and mechanical requirements for a 75 ohm MMCX connector interface primarily used in headends and hubsites in the broadband industry.

1.2. Scope

The purpose of this document is to specify requirements for the male/female interface of a 75 ohm, 3 GHz rated connector series generically known as MMCX-75. This is an indoor connector with applications in controlled environments such as headends and hubsites where high density platform chassis are used. MMCX-75 connectors are not intended to be mated with 50 ohm MMCX design counterparts.

All requirements of this document are measured after installation per manufacturer's instructions of the cable into the connector.

This document will address only the interface, not the connector body, the cable requirements, and the connector attachment to the cable or PC board. Mechanical, electrical and environmental performance is defined to ensure a reliable connection for permanent installations, as well as temporary adapters and calibration standards.

1.3. Benefits

This specification defines the required dimensions and performance for a 75 ohm MMCX connector interface. Such definition ensures that different manufacturer 75 ohm MMCX male plugs and female sockets can be used in broadband network hardware with acceptable interface performance.

1.4. Intended Audience

This document is intended for use as a specification for manufacturers, test laboratories and network engineers in the broadband industry.

1.5. Areas for Further Investigation or to be Added in Future Versions

None.

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

[SCTE 04] ANSI/SCTE 04 2021 – Test Method for "F" Connector Return Loss

[SCTE 48-1] ANSI/SCTE 48-1 2021 – Test Method for Measuring Shielding Effectiveness of Passive and Active Devices Using a GTEM Cell

ANSI/SCTE 200 2022

[SCTE 103] ANSI/SCTE 103 2018 – Test Method for DC Contact Resistance, Drop cable to F-Connectors and F81 Barrels

[SCTE 144] ANSI/SCTE 144 2017 – Test Procedure for Measuring Transmission and Reflection

2.2. Standards from Other Organizations

[Bellcore] Bellcore GR-1503-CORE 4.8

[IEC] IEC 60169-1

[EIA] EIA-364-65

[MIL] MIL-STD-202

2.3. Other Published Materials

No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

No informative references are applicable.

3.2. Standards from Other Organizations

[MIL] MIL-STD-889

3.3. Other Published Materials

No informative references are applicable.

4. Compliance Notation

Shall	This word or the adjective “ required ” means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
Forbidden	This word means the value specified shall never be used.
Should	This word or the adjective “ recommended ” means that there <i>may</i> exist valid reasons in particular circumstances to ignore this item, but the full implications <i>should</i> be understood and the case carefully weighed before choosing a different course.
should not	This phrase means that there <i>may</i> exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications <i>should</i> be understood and the case carefully weighed before implementing any behavior described with this label.
May	This word or the adjective “ optional ” indicate a course of action permissible within the limits of the document.
Deprecated	Use is permissible for legacy purposes only. Deprecated features <i>may</i> be removed from future versions of this document. Implementations <i>should</i> avoid use of deprecated features.

5. Abbreviations

N	newtons
lbs	pound (force)
MΩ	megohm
mΩ	milliohms
MHz	megahertz
V _{rms}	volts root mean square
dB	decibel
in	inches
mm	millimeter
μm	micrometer
V	volts
kV	kilovolt

6. Electrical Requirements

Table 1 – Electrical Requirements of MMCX-75 Plug – Socket Interface only

<u>Electrical Specification</u>	<u>Min</u>	<u>Typ</u>	<u>Max</u>	<u>Unit</u>	<u>Comments</u>
Frequency Range	5		3000	MHz	
Nominal Impedance		75			
Insulation Resistance	1000			MΩ	(Per MIL-STD-202 Method 302)
Dielectric Withstand Voltage	500			V _{rms}	at sea level (per MIL-STD-202 Method 301)
Voltage Rating	300			V _{rms}	at sea level

Surge Withstand			1		kV	Combo Wave in accordance with IEEE C62.41 Category B3
Shielding Effectiveness				-70	dB	ANSI/SCTE 48-1 2021
Insertion Loss				0.2	dB	ANSI/SCTE 144 2017
Center Contact Resistance				10	m Ω	Initial
				18	m Ω	After Conditioning
Outer Conductor Continuity				4	m Ω	Initial
				8	m Ω	After Conditioning*
Return Loss	5-1002 MHz	25			dB	ANSI/SCTE 04 2021 Measuring from interface to PC board mount or interface to cable attachment.
	1-2 GHz	22				
	2-3 GHz	20				

* After Conditioning defined as any single test in Table 8. If a test procedure referenced in Table 8 already defines a maximum deviation from baseline, then that value takes precedence.

7. Mechanical Dimensions

7.1. Female Socket

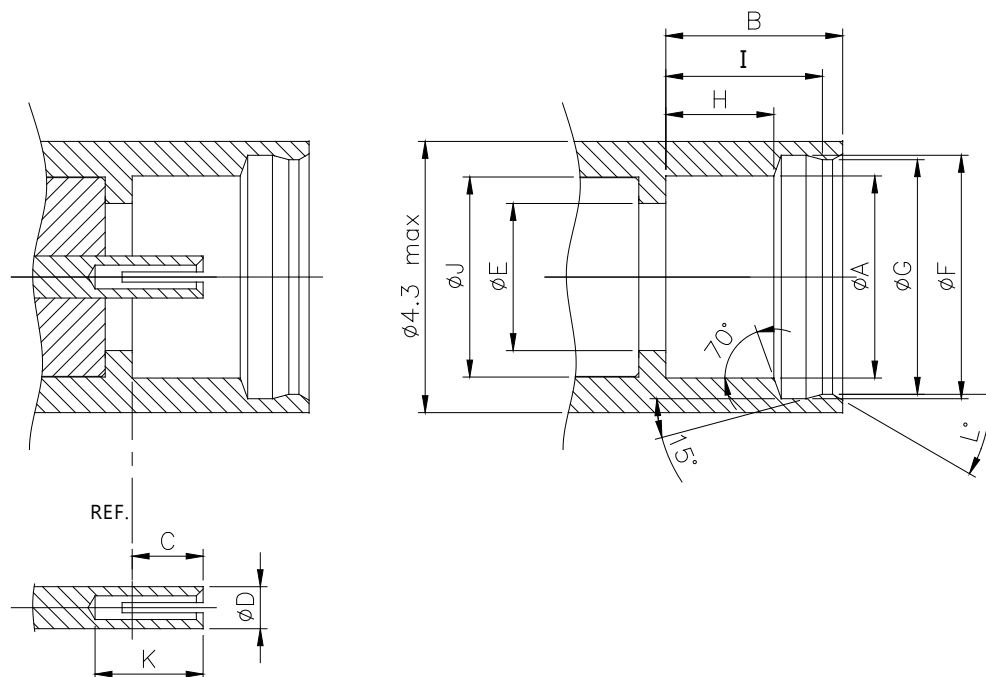


Figure 1 – Female Socket Geometry

Table 2 – Female Socket Dimensions

Reference	mm		in		Note
	Min	Max	Min	Max	
A	2.98	3.03	0.1173	0.1193	1, Diameter
B	2.59	2.65	0.1020	0.1043	
C	0.90	1.20	0.0354	0.0472	
D	0.6	0.64	0.0236	0.0252	Diameter
E	2.15	2.19	0.0846	0.0862	Diameter
F	3.57	3.61	0.1406	0.1421	1, Diameter
G	3.45	3.49	0.1358	0.1374	1, Diameter
H	1.57	1.63	0.0618	0.0642	
I	2.26	2.34	0.0890	0.921	
J	2.95	3.00	0.1161	0.1181	Diameter
K	1.40	2.00	0.0551	0.0787	
L	28	33			Degrees

1. Design to meet electrical and mechanical performance

7.2. Male Plug

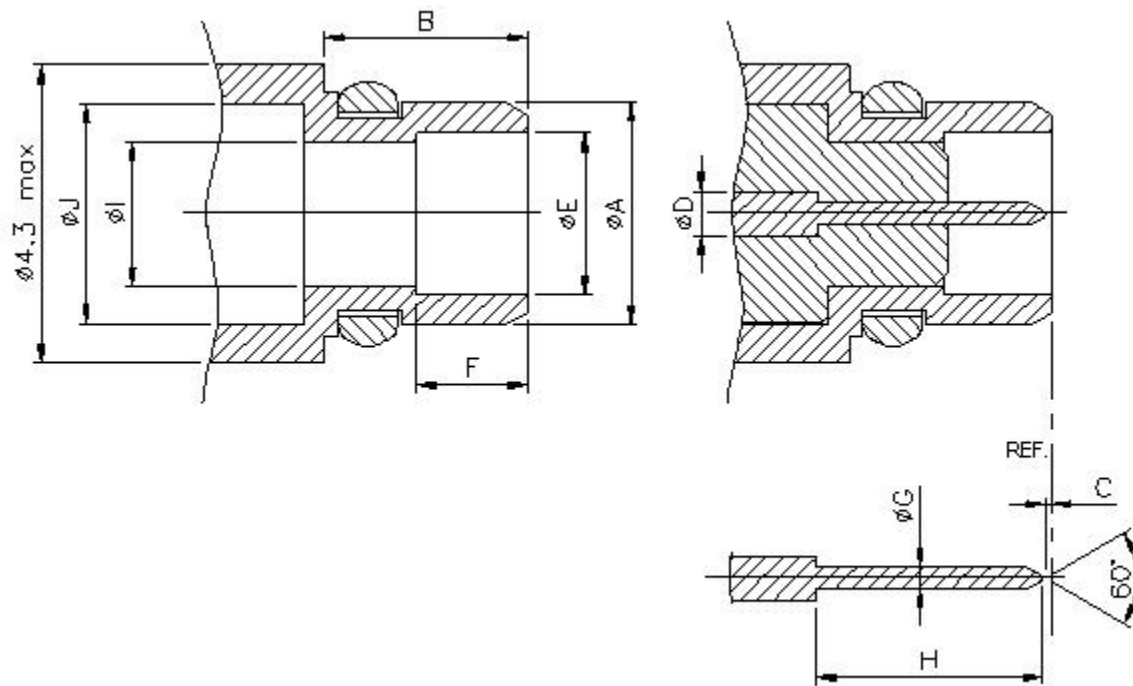


Figure 2 – Male Plug Geometry

Table 3 – Male Plug Dimensions

Reference	mm		in		Note
	Min	Max	Min	Max	
A	2.92	2.97	0.1150	0.1169	1, Diameter
B	2.70	2.76	0.1063	0.1087	
C	0	0.25	0	0.0098	
D	0.60	0.64	0.0236	0.0252	Diameter
E	2.15	2.19	0.0846	0.0862	1, Diameter
F	1.23	1.50	0.0484	0.0591	
G	0.29	0.31	0.0114	0.0122	Diameter
H	3.00	3.10	0.1181	0.1220	
I	1.95	2.00	0.0768	0.0787	Diameter
J	2.95	3.00	0.1161	0.1181	Diameter
	-	3.60	-	0.1417	Diameter
	-	1.20	-	0.0472	

1. Diameter chosen to meet mechanical and electrical requirements

7.3. Center Pin

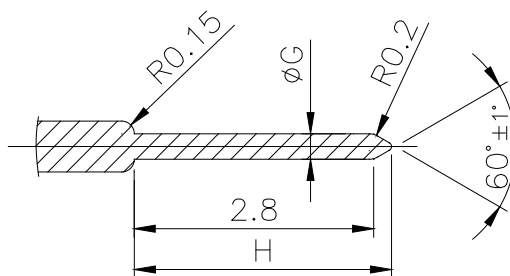


Figure 3 – Gauge for Center Pin

Table 4 – Center Pin Gauge

Ref.	Gauge A				Gauge B			
	mm		In		mm		in	
	min	max	min	max	min	max	min	max
H	3.02	3.08	0.1189	0.1213	3.02	3.08	0.1189	0.1213
G	0.313	0.318	0.01232	0.01252	0.287	0.292	0.01130	0.01150
	N		lbf		N		lbf	
	min	max	min	max	min	max	min	max
Insertion Force *	N/A	10	N/A	2.25	0.25	N/A	0.056	N/A
Retention Force *	N/A	10	N/A	2.25	0.25	N/A	0.056	N/A
Material:	Steel, polished							
	Surface roughness Ra = 0.4 μm max (0.0157 mil)							

* Measured as per sections 7.3.1.1. and 7.3.1.2.

7.3.1. Insertion and Retention Force

Depending on whether the MMCX-75 interface connections are to be used individually or in conjunction with a multi-connector header, the required interface insertion and retention forces can vary. The data in this specification is for individual connector mating forces. Manufacturer specifications for the female socket insertion and retention forces *should* meet equipment requirements when tested as follows

7.3.1.1. Gauge A

Gauge A is to be inserted and removed from the female connector socket 5 times. Both insertion force and retention force are to be measured during the fifth insertion and removal.

7.3.1.2. After testing

After testing is complete using Gauge A, then Gauge B is to be inserted and removed from the female connector socket while measuring insertion and retention force.

For an individual MMCX-75 Female socket the maximum insertion force *should not* exceed 10 N and the retention force *should not* exceed 10 N using Gauge A. The minimum insertion force *should not* be less than .25N and the retention force *should not* be less than .25N using Gauge B.

7.4. Outer Plug

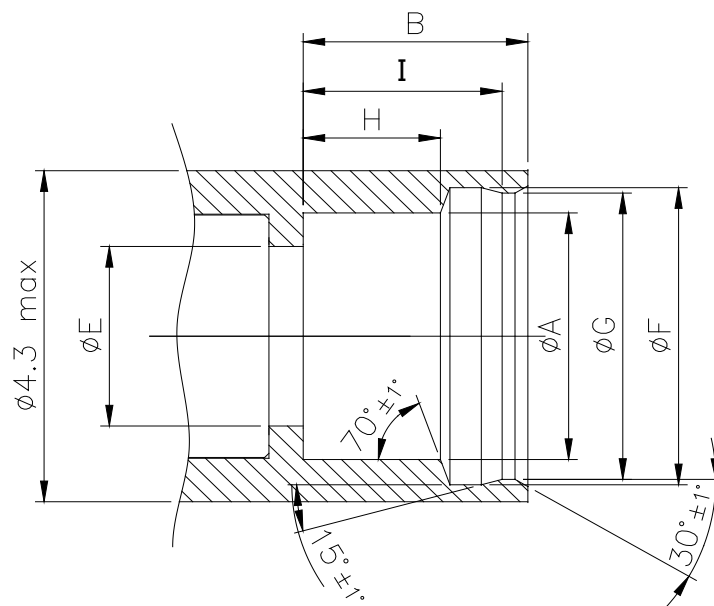


Figure 4 – Gauge for Outer Plug

Table 5 – Outer Plug Gauge

Ref.	Gauge A (max material)				Gauge B (min material)			
	mm		in		mm		in	
	min	max	min	max	min	max	min	max
A	2.98	3	0.1173	0.1181	2.98	3	0.1173	0.1181
B	2.59	2.61	0.1020	0.1028	2.59	2.61	0.1020	0.1028
E	2.15	2.19	0.0846	0.0862	2.15	2.19	0.0846	0.0862
F	3.57	3.59	0.1406	0.1413	3.57	3.59	0.1406	0.1413
G	3.45	3.465	0.1358	0.1364	3.475	3.49	0.1368	0.1374
H	1.57	1.6	0.0618	0.0630	1.57	1.6	0.0618	0.0630
I	2.26	2.28	0.0890	0.0898	2.26	2.28	0.0890	0.0898
	N		lbf		N		lbf	
	min	max	min	max	min	max	min	max
Insertion Force *	N/A	20	N/A	4.50	4.9	N/A	1.102	N/A
Retention Force *	N/A	63	N/A	14.16	4.9	N/A	1.102	N/A
Material:	Steel, polished							
	Surface roughness Ra = 0.4 μm max (0.0157 mil)							

* Measured as per sections 7.4.1.1. and 7.4.1.2.

7.4.1. Insertion and Retention Force

Depending on whether the MMCX-75 interface connections are to be used individually or in conjunction with a multi-connector header, the required interface insertion and retention forces can vary. The data in this specification is for individual connector mating forces. Manufacturer specifications for the male plug insertion and retention forces *should* meet equipment requirements when tested as follows

7.4.1.1. Gauge A

Gauge A is to be inserted and removed from the male connector plug 5 times. Both insertion force and retention force are to be measured during the fifth insertion and removal.

7.4.1.2. After Testing

After testing is complete using Gauge A, then Gauge B is to be inserted and removed from the male connector plug while measuring insertion and retention force.

For an individual MMCX-75 Male Plug connector the maximum insertion force *should not* exceed 63 N and the retention force *should not* exceed 20 N using Gauge A. The minimum insertion force *should not* be less than 4.9N and the retention force *should not* be less than 4.9 N using Gauge B.

7.5. Test Plug

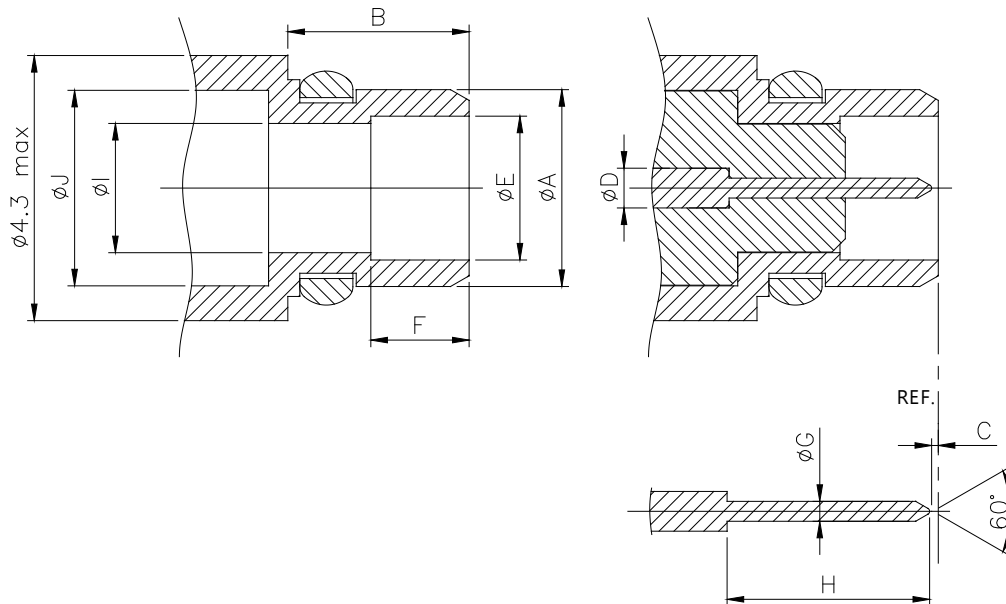


Figure 5 – Test Plug

Table 6 – Test Plug

Ref.	mm		in		Note
	min	max	min	max	
A	2.92	2.95	0.1150	0.1161	Diameter
B	2.7	2.76	0.1063	0.1087	
C	0	0.25	0.0000	0.0098	
D	0.6	0.64	0.0236	0.0252	Diameter
E	2.15	2.19	0.0846	0.0862	Diameter
F	1.23	1.4	0.0484	0.0551	
G	0.29	0.31	0.0114	0.0122	Diameter
H	3	3.1	0.1181	0.1220	
I	1.95	2	0.0768	0.0787	Diameter
J	2.95	3	0.1161	0.1181	Diameter

Mate with test plug five times. Engagement/Disengagement forces of Table 8 apply to first and last cycles.

7.6. Test Socket

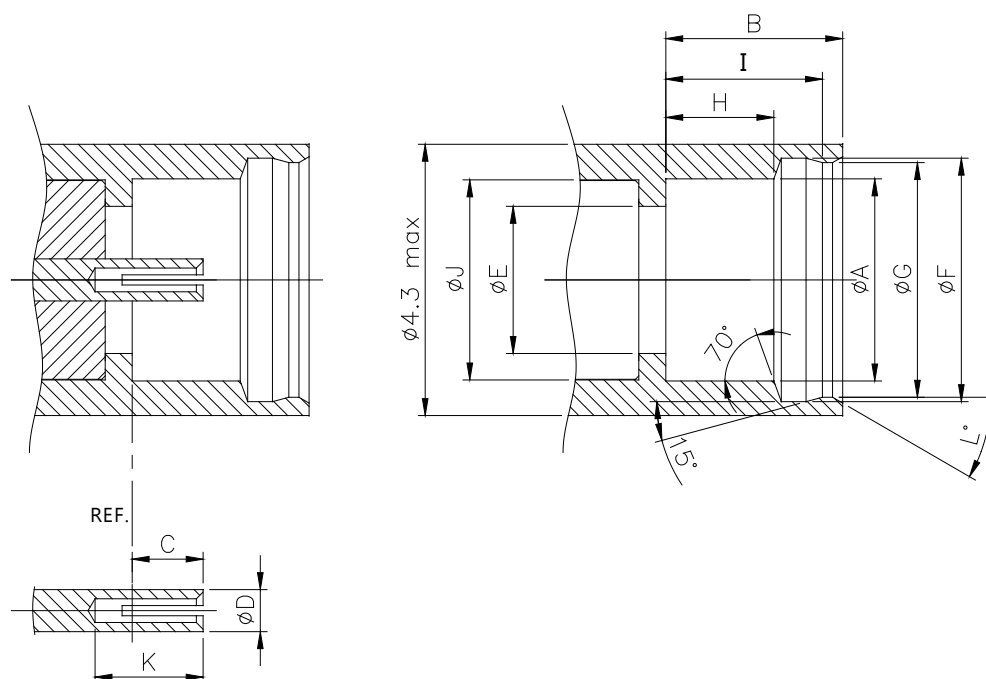


Figure 6 – Test Socket

Table 7 – Test Socket

Ref.	mm		in		Note
	min	max	min	max	
A	2.98	3.02	0.1173	0.1189	Diameter
B	2.59	2.63	0.1020	0.1035	
C	0.9	1.1	0.0354	0.0433	
D	0.6	0.64	0.0236	0.0252	Diameter
E	2.15	2.19	0.0846	0.0862	Diameter
F	3.57	3.61	0.1406	0.1421	Diameter
G	3.45	3.49	0.1358	0.1374	Diameter
H	1.57	1.63	0.0618	0.0642	
I	2.26	2.34	0.0890	0.0921	
J	2.95	3	0.1161	0.1181	Diameter
K	1.4	1.6	0.0551	0.0630	
	min	max			
L	28	33	degrees		

Mate with test socket five times. Engagement/Disengagement forces of Table 8 apply to first and last cycles.

8. Mechanical Requirements

8.1. Base Material

Metal or metal alloy such as brass or zinc.

8.2. Plating

Connector interface contact surfaces *shall* be gold plated. Other surfaces can be gold or nickel plated as per the manufacturer specifications. Any other plating chosen *should* be within .3V of Gold on the Anodic chart for galvanic compatibility.

Table 8 – Mechanical Requirements of MMCX-75 Plug – Socket Interface

Mechanical Specification	Min	Typ	Max	Unit	Comments
Contact Captivation	10 (2.25)			N (lbf)	For captive contact designs only. Center contact to connector body force.
Durability	500			cycles	

9. Environmental Requirements

9.1. Temperature

Temperature rating: -40C - +85C operational ambient temperature

9.2. Specifications

The following specifications *should* be included with the manufacturer's specifications and could vary depending on equipment requirements.

Table 9 – Environmental Specifications

Environmental Specification	Comments
Mechanical Shock	per MIL-STD-202, method 213, Condition B
Vibration	per MIL-STD-202, method 204, Condition B
Thermal Shock	per MIL-STD-202, method 107, Condition F
Chemical Resistance(indoor)	Bellcore GR-1503-CORE 4.7
Mix Flow Gas	max change over baseline as per EIA-364-65, Condition IIA