

## Stopper Rod

### Introduction & Application

Morgan Molten Metal Systems has developed its new product range of stopper rods (or monoblock stoppers) for Ferrous applications. After conducting various laboratory trials to select the right materials and optimum process parameters, Morgan has launched its stopper rods for the ferrous foundry application.

These stoppers are mainly used in Auto-Pour applications i.e. unheated tundish systems as well as press-pour systems. Morgan's stopper rods are based on alumina-graphite compositions which are primarily for grey and ductile iron applications. The ceramic-bonded stopper rods have a refractoriness of 1600-1700°C with significant strength and erosion resistance. Morgan's advanced technology of material processing results in homogeneous structure, which further yields excellent performance at customers' applications. Morgan can prepare the open and closed stopper rods for iron foundries. The open stopper rods are for ductile iron applications where plunging and purging of the nozzle is needed to ensure continuous flow of molten metal. The closed stopper rod is for grey iron applications where there is no purging or plunging. For every length and diameter, Morgan can prepare closed or open ended stopper rods.



**Stopper Rod in Operation**



**3-D view of Stopper Rod**



### Physical Properties

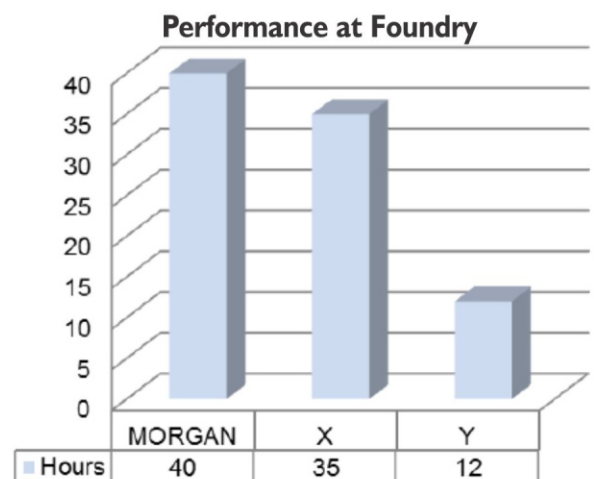
Apparent Porosity	15 % - 17 %
Bulk Density	2.2 - 2.3 gm/cc
C.C.S.	20 - 24 MPa

### Chemical Composition

Carbon	32 % - 36 %
Al <sub>2</sub> O <sub>3</sub>	33 % - 37 %
SiO <sub>2</sub>	12 % - 16 %
Si	04 % - 06 %
Na <sub>2</sub> O, K <sub>2</sub> O, Fe <sub>2</sub> O <sub>3</sub> , B <sub>2</sub> O <sub>3</sub> & others	08 % - 10 %

### Proven Success

Morgan stopper rods have been tested at various global sites. Foundries have appreciated the robustness of the product and its consistency in quality. An Asian Foundry has reported the performance, in terms of casting hours of suppliers 'X' and 'Y' in order to compare with Morgan's stopper rod. Morgan provided 3 samples for trial and the stopper rods showed a consistent performance of 40 casting hours. However, 'X' performed for 35 casting hours and 'Y' lasted for 12 casting hours with inconsistencies. Morgan's performance has reduced the changeover time, thereby reducing labour costs and production downtime as well as reduced metal loss. The performances of the stopper rods at the foundry are shown, adjacently.



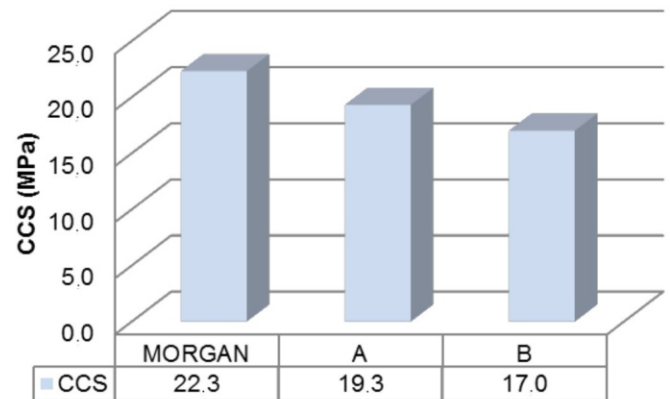
All dimensions are subject to normal manufacturing tolerances. Morgan reserves the right to change specifications at any time

## Stopper Rod

### Strength: A Measure of Performance

As we carried out several laboratory trials before launching the product, our customers informed us that the strength is the top parameter for this product range due to its high stress application. The pouring application is controlled by the continuous lifting and dropping of the stopper rod, where the nose (curved region) is striking against the nozzle. Therefore Morgan carried out some Cold Compression Strength (CCS) tests in order to determine the right mix and create a comparison with the competition. It can be observed in the graph below that the Morgan stopper rod exhibits a 14-24% increase in strength in comparison to 'A' and 'B', which are samples taken from other suppliers, which implies less damage to the stopper rod leading to consistent metal flow during casting.

Comparison in strength



### Salamander Super "Iso pressed" Stopper Rod



Stopper Rod schematics



OPEN



CLOSED

TYPE/SIZE	LENGTH		OD		ID		NOSE END	VARIATIONS
	mm	inch	mm	inch	mm	inch		
STOPPER ROD -403X90	403	15.9	90	3.5	42	1.7	Open	-
STOPPER ROD -450X90	450	17.7	90	3.5	42	1.7	Close	A, B, S
STOPPER ROD -475X90	475	18.7	90	3.5	20	0.8	Close	-
STOPPER ROD -475X105	475	18.7	105	4.1	42	1.7	Open	-
STOPPER ROD -475X111	475	18.7	111	4.4	42	1.7	Open	-
STOPPER ROD -508X102	508	20.0	101	4.0	41	1.6	Open	-
STOPPER ROD -635X108	635	25.0	108	4.3	37	1.5	Open	-
STOPPER ROD -858X106	858	33.8	106	4.2	42	1.6	Open	-
STOPPER ROD -864X108	864	34.0	108	4.3	42	1.7	Open	-
STOPPER ROD -900X105	900	35.4	105	4.1	42	1.7	Open	-
STOPPER ROD -1168X114	1168	46.0	114	4.5	37	1.5	Open	A, E, F
STOPPER ROD -403X90	403	15.9	90	3.5	42	1.7	Open	-

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## Nozzle

### Introduction & Application

Nozzles are ideal for bottom pour ladles and auto pour systems providing good casting quality, increase in productivity and better safety in environment of the plant. The refractory, clay graphite materials used for making these nozzles have been thoroughly researched & experimented upon to provide enhanced life in extremely tough environment.

Perfect seating radius & no metal leakage over multiple openings at high operating temperatures, supported with excellent erosion resistance form the primary characteristics of Morgan Nozzles.

We can provide reverse tapered nozzles (RT) as well as Oblique nozzles (O).

#### Refractory Nozzle



#### Physical Properties

Apparent Porosity	18 % - 22 %
Bulk Density	2 - 2.3 gm/cc

#### Chemical Composition

Carbon	Not present
Al <sub>2</sub> O <sub>3</sub>	51 % - 53 %
SiO <sub>2</sub>	40 % - 42 %
SiC	Not present
Others	06 % - 09 %

#### Clay Graphite Nozzle



#### Physical Properties

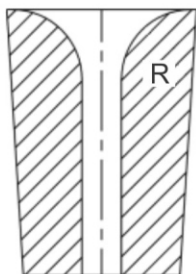
Apparent Porosity	20 % - 28 %
Bulk Density	2.1 - 2.3 gm/cc
C.C.S.	200 - 300 Kg/cm <sup>2</sup>
P.C.E.	35 - 37 Orton Cone

#### Chemical Composition

Carbon	12 % - 14 %
Al <sub>2</sub> O <sub>3</sub>	52 % - 54 %
SiO <sub>2</sub>	25 % - 27 %
Others	05 % - 10 %

#### Salamander Super Refractory Nozzle Sizes

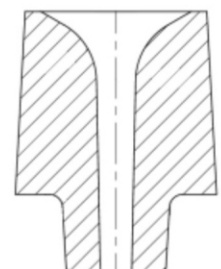
PATTERN NO.	TOD mm	BOD mm	HT mm	RAD mm	BOREDIAMETER mm
NZS-I	139	99	200	50	20,23,26,30,35,40,45,55
NZ-T	120	140	90	50	35
NZ-447	135	120	120	50	40
NOZZLE-494-24	139	77	200	50	24
NOZZLE-469.1-35	108	73	228	50	35,38,29,20



**Oblique Nozzle schematic**

#### Salamander Super Clay Graphite Nozzle Sizes

PATTERN NO.	TOD mm	BOD mm	HT mm	RAD mm	BOREDIAMETER mm
NZS-I T-68 HR	139	99	200	50	20,23,26,30,35,40,45,55
NZ-T-68 HR	120	140	90	50	35
NZ-447-T-68 HR	135	120	120	50	40
NOZZLE-494-24-T-68 HR	139	77	200	50	22
NOZZLE-469.1-35-T-68-HR	108	73	228	50	35,38,29,20



**Reverse Tapered Nozzle schematic**

Both Reverse Tapered & Oblique nozzles are available in refractory as well as clay graphite materials.

All dimensions are subject to normal manufacturing tolerances. Morgan reserves the right to change specifications at any time

## Stopper Head

A complete range of Salamander<sup>TM</sup> Plumbago stoppers for bottom pour ladles is available in a range of sizes and designs. Morgan stopper rod ends are used by attaching to a steel rod, which is sheathed with refractory tubes for protection from the molten metal.

Our stoppers do not stick to the ladle nozzle when lifted and consistently reseal without leaks when closed off. Multiple openings while pouring a single ladle, without any leakage or nose erosion/sticking are primary characteristics of Morgan stoppers.



### Physical Properties

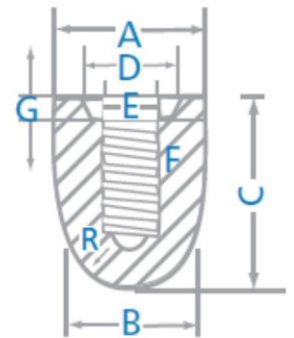
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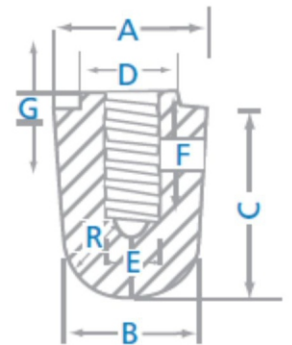
### Salamander Super Stopper Head S Type

NOMINAL DIA	PATTERN NO	A	B	C	D		E	F	G	R	P
90	S.0	90	80	120	68	62	33.5 / 23.5	13	12	40	6
105	S.1	105	90	130	78	72	38.5 / 28.5	13	12	45	6
120	S.2	120	110	125	86	72	38.5 / 28.5	13	12	55	6
140	S.3	140	120	145	86	72	38.5 / 28.5	13	12	60	6
155	S.4/2	155	130	155	97	82	38.5 / 28.5	13	12	65	6
170	S.5	170	130	170	115	97	38.5 / 28.5	13	12	65	6



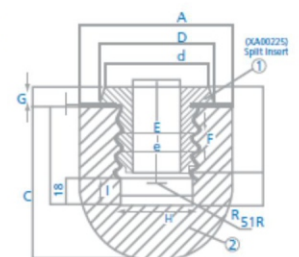
### Salamander Super Stopper Head RS Type

NOMINAL DIA	PATTERN NO	A	B	C	D		E	F	G	R	P
90	RS.22	89	86	114	57 / 56	28 / 21	13	10	43	6	
100	RS.23	100	88	130	64 / 62	38 / 28	13	10	44	6	
115	RS.24	115	102	142	7 / 68	38 / 28	12	10	51	6	
130	RS.26	130	110	130	72 / 70	37 / 28	12	10	55	6	



### Salamander Super RS Stopper Head and Screw

NOMINAL DIA	PATTERN	A	B	C	D		E	F	G	R	P	
90	RS-395	90	84	100	64	63	58	50	12	10	44	4
100	RS-431	102	100	103	57	47.5	48	47	12	12	51	4
100	RS-442	102	100	109.5	57	47.5	54	45	12	9.5	51	4
100	RS-439	102	100	103	57	47.5	48	47	12	12	51	4
115	RS-415	114.5	111	108	57	47.5	55	45.5	12	24	55.5	4
120	RS-414	152.5	150	149	101.5	92	99.5	90	12	28	101.5	4
115	RS-441	114.5	111	108	57	47.5	55	45.5	12	12	55.5	4
120	RS-438	120	104	125	69	59.5	57.5	53	12	9.5	52	4



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