



INTERNATIONAL CASTING & MODERN INDUSTRIES CO.  
الشركة العالمية للمسيوكات والصناعات المتطورة

## Control Plan

ICMI

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Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/ Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
								Size	Frequency				
<b>Operation: 00 - Receiving</b>													
1	00-1	All	Receiving New Sand	AFS Number	Sieve analysis	Lab Sifter	Molding Sand: 46--54 AFS Housing Core: 46-54AFS	1 Sample	Lot	Lab	Compare with internal spec. the rejection will be to any sand out the range of 46 - 54 AFS, the sand will be identified as following: Molding sand: 46-54 AFS Core sand: 46 - 54 AFS	QC OP 01	QC RC 01
2	00-2	All	Receiving Bentonite	Review the supplier certificate	---	---	---	---	Batch	Quality	Compare customer receiving certificate with internal spec. and accept or reject the lot	QC OP 01	QC RC 01
3	00-3	All	Receiving steel shot	Review the supplier certificate	---	---	---	---	Batch	Quality	Compare customer receiving certificate with internal spec. and accept or reject the lot	QC OP 01	QC RC 01
4	00-4	All	Receiving metal additives (Cu, FeMn, FeSi and FeSiMg)	Review certificate. Cu: visual inspection and clean from plastic if any	---	---	---	---	Batch	Quality	Compare supplier receiving certificate with the internal spec. and accept or reject the lot	QC OP 01	QC RC 01



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<b>Operation: 00 - Receiving</b>													
5	00-5	GGG	Review steel scrap	Review the chemical analysis & visual inspection	Chemical composition visual aid	Spectrometer	<u>Ductile Iron</u> Cr: 0.055 % max Si: 0.40 % max Mn: 0.40 % max P: 0.03 % max S: 0.02 % max Mo: 0.05 % max B: 0.007 % max V: 0.05 % max AL: 0.10 % max Sn: 0.06 % max Ni: 0.10 % max Ti: 0.01 % max Pb: 0.01 % max	1 Samples	Lot	Lab Metal dept.	Compare the average analysis of the two samples with internal spec. and reject or accept the lot.	QC OP 01	QC RC 01
6	00-6	GG	Review steel scrap	Review the chemical analysis & visual inspection	Chemical composition visual aid	Spectrometer	<u>Grey Iron</u> Cr: 0.1 % max Si: 1 % max Mn: 1 % max P: 0.06 % max S: 0.06 % max Mo: 0.05 % max B: 0.007 % max V: 0.05 % max AL: 0.15 % max Sn: 0.06 % max Ni: 0.10 % max Ti: 0.01 % max Pb: 0.01 % max	1 Samples	Lot	Lab Metal dept.	Compare the average analysis of the two samples with internal spec. and reject or accept the lot.	QC OP 01	QC RC 01


Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/ Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
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<b>Operation: 10 - Metal</b>													
7	10-1	All	Charging	Charge weight (Kg)	Weighing the charge	Balance	According to Work instruction	100%	Every charging operation	Furnace operator	Weigh additives manually then add with the charge to the furnace	PRD PR 03	PRD RC 06
				Additives amount	weighing and adding the additives	Balance							
8	10-2	All	Melting	Chemical analysis (percentage of every element)	Chemical analysis	Spectrometer	According to the material grade <u>See table 1</u> <u>Chemical compisition &amp; Pouring Temperature and time</u>	1 Sample	Every melt	Lab.	Additives manually added, and take sample to check the furnace	PRD PR 03	Spectrometer outpot
9	10-3	All	Melting	Tapping Temperature	Thermo - couple	Dipping Thermocouple	1350°C - 1450 Grey Iron 1500 - 1550 Ductilr Iron	Min. 1 check	Every melt	Furnace operator	Applying the power required for heating	PRD PR 03	PRD RC 06 & QC RC 07
10	10-4	All	Treatment	Ladel status	Visual	Manualy	Red hot clean ladle.	1 check	Every ladle	Treatment operator	Changing the ladle and reheating the ladle		
11	10-5	GGG	Treatment	Amount of master alloy (FeSiMg)	weighing the added master alloy	Balance	FeSiMg alloy: 20 kg/ ton Max.	100%	Befor every treatment process	Treatment operator	Weigh the master alloy manually	PRD PR 03	PRD RC 06
12	10-6	GGG	Treatment	Amount of inoculation	Weighing the MSI grade inoculation	Balance	Ferrosilicon Barium 1.5Kg / 500kg metal	100%	On ladle inoculation	Treatment operator	Put the inoculation during the tapping in the ladle	PRD PR 03	





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<b>Operation: 10 - Metal</b>													
13	10-7	All	Ladle deslagging	Deslagging	Visual	Manually	Acceptable Clean Metal	100%	Every ladle	Deslagging operator	Re-deslag		
14	10-8	All	Mg Recovery	Recovery	Chemical analysis	Spectrometer	Min. 0.03 Mg in the ladle just before pouring	1 check	Every ladle	Quality inspector	If Mg% in Ladle less than 0.03 Reject the molds	Control Plan	Spectrometer output
15	10-9	All	Pouring	Inoculation efficiency	Check the wedge chill width with the inoculation amount	Visual + caliper if needed	Chill width 8mm max before inoculation and 4 mm max after inoculation	Ladle	per Ladle	Quality inspector	Before the inoculation increase the Si% in the furnace. -Return the ladle to the furnace and adjust the Si contents.	PRD PR 03	

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Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/ Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
								Size	Frequency				
<b>Operation: 20 - Sand</b>													
16	20-1	All	Sand Preparation	Compactability	Applying a standerd compacting force	Pneumatic rammer	(42 - 52%)	1 sample	Every 3 hours max.	Beloi M/C	Mixer automatic water regulator	QC OP 03	QC RC 20
17	20-2	All	Sand Preparation	Moisture content	Weighing of the sand befor and after drying	Drying oven + Sensitive balance	(3.5 - 5.0%)	1 sample	Every 3 hours max.	Lab.	Mixer automatic water regulator	QC OP 03	QC RC 20
18	20-3	All	Sand Preparation	Permeability	Folw rate of air through a standerd specimen	Direct absolute perimeter	(110 - 200)	1 sample	Every 3 hours max.	Lab.	Check and adjust fines content and additives to the accepted content	QC OP 03	QC RC 20
19	20-4	All	Sand Preparation	Green compressive strength	Compressing a standerd specimen till failure	universal sand strength m/c	(12-20 PSI)	1 sample	Every 3 hours max.	Lab.	Check active clay and add bentonite if required	QC OP 03	QC RC 20
20	20-5	All	Sand Preparation	Bentonite percentage (Active clay)	Interaction between Methylene blue and the active clay	Methylene blue clay tester plus accessories	( 8 -12 % )	1 sample	Every 3 hours max.	Lab.	Adapt the value of added bentonite to the mixer	QC OP 03	QC RC 20
21	20-6	All	Sand Preparation	Loss on ignition (LOI)	Weighing of the sand before and after heating	Muffle furance + Sensitive balance	(5 - 6.5%)	1 sample	Every Week.	Lab.	Adjust the amount of coal dust added to the mixer through the control room panel	QC OP 03	QC RC 20
22	20-7	All	Sand Preparation	Total fines (TF)	Weighing of the sand before and after Washing	washing Flask + Muffle Furnace + Sensitive balance	(12.5 - 14.5 %)	1 sample	Every Week.	Lab.	Add New Sand and check the effeciency of Dedasting system	QC OP 03	QC RC 20

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Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
								Size	Frequency				
<b>Operation: 30 - Cores (For cored products only)</b>													
23	30-1	All	Core making	Resin % ( 1 ) Resin % ( 2 ) Catalyst	—	Core M/C	According to WI	1 Check	Every shift	core M/C operator	Readjusting quantities	PRD PR 01	
24	30-2	All	Core making	Core appearance (Damage, Fins, cracks, etc)	Visual	Manually	No broken part, not friable	100%	Every shot	Core quality operator	Reject the bad core	QC OP 03	

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Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/ Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
								Size	Frequency				
<b>Operation: 50 - Inspection</b>													
25	50-1	All	Off line lab inspection	Lay out inspection	Measuring	Manual Measuring Devices	According to the related drawing	One piece every 4000 pieces		Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
26	50-2	All	Off line lab inspection	Average hardness on different points on the specified section of the product	Resistance offered by the surface	Hardness Taster	According to the customer requirement	One piece every 4000 pieces		Quality inspector	Stop and check all casting processes and evaluate the product	QC OP 03	QC RC 21
27	50-3	All	Off line lab inspection	Tensile strength and elongation	Tenes the specimen till failure	Universal strength m/c Out Sourcing	According to the material grade specification	One piece every 4000 pieces		Quality inspector	Reject The batch	QC OP 03	QC RC 21
28	50-4	All	Off line lab inspection	Microstructure	Visual	Microscope	According to the material grade specification	One piece every 4000 pieces		Quality inspector	Stop and check all casting processes and evaluate the product	QC OP 03	QC RC 21
29	50-5	All	Final inspection	Contour line, cast defects, brightness, fetting defects	Visual	Manual	According to customer specification	100%		Quality inspector	Reject the defected parts and define the precentage of the defect	QC OP 02	QC RC 08
30	50-6	Gully tops and manhole tops (Table 1)	Off line lab inspection	Measuring the permanent set	Permissible Permanent Set	Press	According to table 2 (BS EN 124 8.1 to 8.3)	3 pieces	One piece every 4000 pieces	Quality inspector	Reject the batch	QC OP 03	QC RC 21
31	50-7	Gully tops and manhole tops (Table 1)	Final Inspection	Vents	Visual	Manual	According to specification BS EN 124 Table A.3	100%		Quality inspector	Reject the cover	QC OP 03	QC RC 21
32	50-8	Gully tops and manhole tops (Table 1)	Final Inspection	Vents Dimension	Measuring	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
33	50-9	Gully tops and manhole tops (Table 1)	Final Inspection	Clear Opening	Measuring	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
34	50-10	Gully tops and manhole tops (Table 1)	Final Inspection	Depth of insertion	Measuring	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21






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Ser.	Operation #	Material	Operation Description	Characteristics	Measurement Technique	Machine/Device/Equipment/Tools	Specification / Tolerance	Sample		Responsible	Reaction Plan	Documents	Records
								Size	Frequency				
<b>Operation: 50 - Inspection</b>													
35	50-11	Gully tops and manhole tops (Table 1)	Final Inspection	Total Clearance	Measuring	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
36	50-12	Gully tops and manhole tops (Table 1)	Final Inspection	Seating	Measuring	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
37	50-14	Gully tops and manhole tops (Table 1)	Final Inspection	Mass	Weigh	Balance	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
38	50-15	Gully tops and manhole tops (Table 1)	Final Inspection	Slot dimension	Measure	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
39	50-16	Gully tops and manhole tops (Table 1)	Final Inspection	Positioning	Visual	Manual	According to specification BS EN 124 Table A.3 and product Drawing	100%		Quality inspector	Check the assemble process	QC OP 03	QC RC 21
40	50-17	Gully tops and manhole tops (Table 1)	Final Inspection	Frame bearing area	Measure	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
41	50-18	Gully tops and manhole tops (Table 1)	Final Inspection	Frame depth	Measure	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the casting process	QC OP 03	QC RC 21
42	50-19	Gully tops and manhole tops (Table 1)	Final Inspection	Opening angle	Measure	Manual	According to specification BS EN 124 Table A.3 and product Drawing	1 pieces	One piece every 4000 pieces	Quality inspector	Check the pattern dimensions and check the assembly process	QC OP 03	QC RC 21
43	50-20	Gully tops and manhole tops (Table 1)	Final Inspection	Marking	Visual	Manual	According to specification BS EN 124 Table A.3 and product Drawing	100%		Quality inspector	Check the pattern and the process	QC OP 03	QC RC 21

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	Table 1: Chemical Composition & Pouring Temperature				
Material Grade	Chemical Analysis				Pouring Temperature
	Melting Furnace	After Treatment	Tensile	Hardness	
<b>GGG 50</b>	C: 3.75 -3.9% Si: 1.6 max Mn: 0.35 % max P: 0.05% max S: 0.35% max Cu: 0.70% max Ni: 0.15% max Cr: 0.07% max Al: 0.02% max Sn: 0.02% max B: 0.007% max	C: 3.6 - 3.95% Si: 2.45 -2.80 Mn: 0.45 max P: 0.05% max S: 0.025% max Cu: 0.70% max Mg: 0.030-0.065% Ni: 0.15% max Cr: 0.07% max Al: 0.02% max Sn: 0.02% max B: 0.007% max Si plus 5 kg / ton inoculation	500 Mpa Min	185-240	<b>As per product list</b>
<b>GGG 40</b>	C: 3.75 -3.9% Si: 1.6 max Mn: 0.30 % max P: 0.05% max S: 0.035% max Cu: 0.15% max Ni: 0.15% max Cr: 0.07% max Al: 0.02% max Sn: 0.02% max B: 0.007% max	C: 3.6 - 3.85% Si: 2.5 -2.70 Mn: 0.45 max P: 0.05% max S: 0.025% max Cu: 0.15% max Mg: 0.030-0.065% Ni: 0.15% max Cr: 0.07% max Al: 0.02% max Sn: 0.02% max B: 0.007% max Si plus 5 kg / ton inoculation	400 Mpa Min	185-240	<b>As per product list</b>
<b>GG 15</b>	C: 3.40-3.6% Si: 2.25 - 2.55% Mn: 0.4 - 0.6% P: 0.06% max S: 0.1% max Cu: 0.15% max Ti: 0.015% max Cr: 0.15% max Al: 0.015% max Sn: 0.08% max Ni: 0.15% max	Si plus 3 kg / ton inoculation	150 Mpa Min	185-240	<b>As per product list</b>
<b>GG 20</b>	C: 3.30-3.5% Si: 2.05 - 2.25% Mn: 0.4 - 0.6% P: 0.06% max S: 0.1% max Cu: 0.15% max Ti: 0.015% max Cr: 0.15% max Al: 0.015% max Sn: 0.08% max Ni: 0.15% max	Si plus 3 kg / ton inoculation	200 Mpa Min	185-240	<b>As per product list</b>
<b>GG 25</b>	C: 3.10-3.3% Si: 1.85-2.15% Mn: 0.5-0.8% P: 0.06% max S: 0.1% max Cu: 0.15% max Ti: 0.015% max Cr: 0.15% max Al: 0.015% max Sn: 0.08% max Ni: 0.15% max	Si plus 3 kg / ton inoculation	250 Mpa Min	185-240	<b>As per product list</b>

Pos. No.	Part Number	Product Type	Material Grade	Set Weight (Kg)	Prod. Line	Class	CO	Permissible Permanent Set (mm)
1	DU001 (400/07/08)	Gully tops and manhole tops	ISO 1083 Grade 500/7 S.G. NODULAR IRON	63.6	BL	D 400	600	2
2	DU002 (400/07/11)			76.6	BL	D 400	600	2
3	DU020 (400/199/200)			22.9	J.S	D 400	300	1
4	Du022 (400/37/38)			78.8	BL	D 400	675	2.25
5	DU034 (400/155/156)			77	BL	D 400	600	2
6	DU036 (400/96/97)			29.7	BL	D 400	375	1.25
7	DU040 (400/203/204)				D 400	400	1.34	
8	DU043A (125/10/94)			29.5	BL	B 125	450	1.5
9	DU044A (125/12/13)			36.5	BL	B 125	600	2
10	DU060 (400/138/139-50)			57.2	BL	D 400	450	1.5
11	DU077 (400/197/198)			9	J.S	D 400	150	1
12	DU079 (400/86/87-50)			45	J.S	D 400	450	1.5
13	DU084 (400/37/74)			91.9	H.M	D 400	675	2.25
14	DU099 (400/97/130)			34.2	BL	D 400	375	1.25
15	Du116 (400/195/196)			27.9	J.S	D 400	280	1
16	DU135 (400/215/96)			31.4	J.S	D 400	375	1.25
17	DU136 (400/215/130)			35.9	BL	D 400	375	1.25