



FUNDICIÓN

MATERIAS PRIMAS



Materias primas para los procesos de Fundición

Fusión de Aleaciones

Chatarras	Piezas falladas o salidas de servicio, o bien subproductos (sobrantes) de procesos de conformado
Retornos	Piezas defectuosas, alimentadores y sistemas de colada (del proceso de fundición)
Arrabios	Materia prima para aleaciones ferrosas
Ferroaleaciones	Para ajuste de carga de aleaciones ferrosas
Aleaciones liga ó aleaciones madre	Para ajuste de carga de aleaciones no ferrosas
Lingotes de Metales puros	Para aleaciones no ferrosas, materias de ajuste de carga

Clasificación de cargas

Materia prima
(cargas)

Tipo

Chatarras
Arrabios
Retornos

Materias primas **primarias**

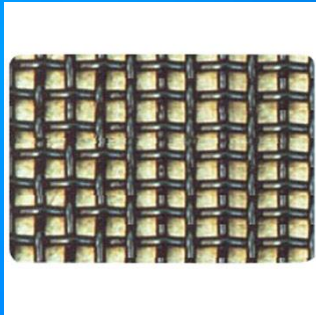
Ferroaleaciones
Aleaciones liga
Lingotes de metales puros

Materias primas **secundarias**
(ajuste de carga)

Fundentes

Materias primas **auxiliares**

Chatarras. Una vez terminada su función o una vez que fallaron



Chatarras. Una vez terminada su función o una vez que fallaron





Bajada de Agua



Laminas



Chatarras. Una vez terminada su función o una vez que fallaron





Chatarras. Una vez terminada su función o una vez que fallaron

El origen de la chatarra o las chatarras del automóvil presenta tres fuentes diferenciadas



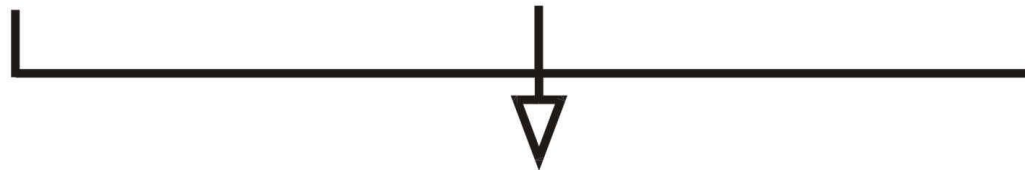
Vehículos dados de baja
por obsolescencia debida al uso



Vehículos dados de baja
debido a accidentes



Vehículos abandonados



CHATARRA









Forma de las chatarras

Las chatarras pueden tener la forma de componentes completos, monoblocks, motores, ollas, sartenes, perfiles, coladeras, tubos, recipientes, contenedores, etc., Componentes fallados o desechados.

O bien pueden tener la forma de laminas, recortes, cilindros, etc., sobrantes de procesos de conformado

Independientemente de su origen pueden tener óxidos, grasas, aceites, productos de corrosión y suciedad anexa.

Tratamiento de las materias primas primarias

Selección

Selección visual

Separación por tipo de metal de forma visual (aluminios, cobres, aceros, etc.

Selección magnética

Separación por tipo de metal (material magnético y material no magnético)

Preparación

Limpieza Física

Limpieza Química

Limpieza de grasas, aceites, productos de corrosión, suciedad anexa, pinturas, etc

Recorte y /o empaque

Dependiendo de la forma de las chatarras, éstas pueden quedar de igual tamaño al introducirse

A los hornos o bien habrá necesidad de cortar y/o empacar a las chatarras

Ejemplos

Virutas de los talleres de procesos de corte. Se deberá, aparte de eliminar grasas y aceites, de empacar para evitar demasiada área superficial, lo que provoca pérdidas excesivas por oxidación durante la fusión.

Monoblocks. Si este es demasiado grande para la boca de entrada al horno se deberá de cortar al tamaño adecuado, en dos o más trozos. Es necesario mencionar que se deben de eliminar grasas y aceites

Láminas. Como subproducto de procesos de recorte, estampado, etc. Se deberán de cortar y quizá empacar. De igual manera se deben eliminar grasas y aceites



Pacas

Retornos

Como productos del proceso de fundición (piezas defectuosas, alimentadores, sistemas de colada) principalmente tienen en su superficie arena adherida, la cual se debe eliminar a través de procesos físicos de limpieza (sandblast, airblast y shootblast)

Generalmente a los arrabios, ferroaleaciones, aleaciones liga y metales puros no se les da tratamiento alguno, ya que se encuentran limpios.

Todas las materias primas, una vez preparadas, deben precalentarse antes de introducirlas a los hornos. Esto con 3 objetivos

- Eliminación de humedad
- Evitar el choque térmico con los refractarios de los crisoles de los hornos
- Aumento de la velocidad de fusión

Cargas.



Chatarras

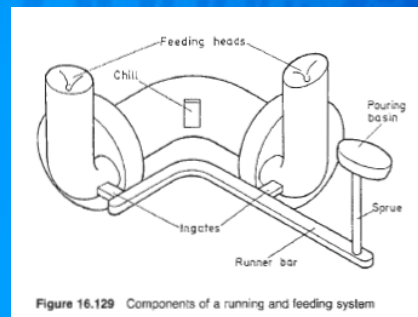


Figure 16.129 Components of a running and feeding system

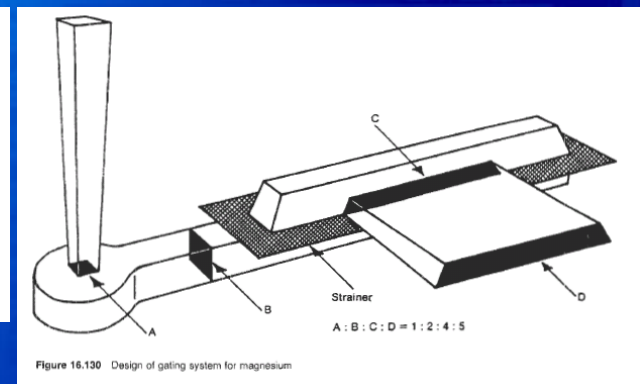


Figure 16.130 Design of gating system for magnesium

Retornos
(del 5% - al 30% de la carga total)

Ferroaleaciones y aleaciones liga



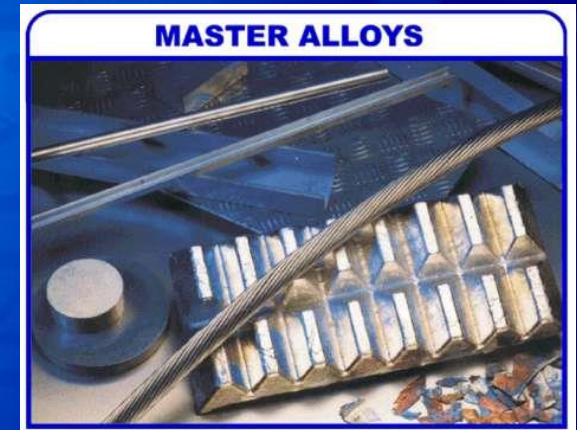
AlTiB



FeSiMg



Si

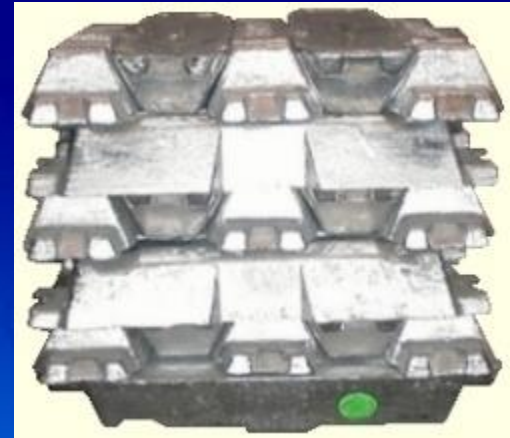


Cobre cátodo



Metales Puros

Estiba de **aluminio** primario



Zinc lingote estibas



Table 9. Typical Compositions of Gray Iron Based on Strength and Section

Type	TC	Composition, % Si P S Mn	Average carbon equivalent(a)	Metal section range, in.	Brinell hardness number	Transverse load, lb	Transverse deflection, in.	Tensile strength, psi
Class 20,.....	3.50	2.40 0.20 0.08 0.50	4.56	Up	160	900	0.10	22,000
light section,	to	to to to to	...	to	to	to	to	to
0.875-in. test bar	3.80	2.60 0.80 0.13 0.70	...	0.50	200	1200	0.15	26,000
Class 20,.....	3.40	2.30 0.20 0.08 ...	4.34	1/2	160	1600	0.20	18,000
medium section,	to	to to to to	...	to	to	to	to	to
1.2-in. test bar	3.60	2.50 0.60 0.80 ...	...	1	180	2200	0.27	24,000
Class 20,.....	3.10	2.20 0.20 0.08 0.50	3.98	1	130	4500	...	18,000
heavy section,	to	to to to to	...	and	to	to	...	to
2.0-in. test bar	3.30	2.40 0.40 0.13 0.80	...	up	180	6500	...	22,000
Class 25,.....	3.30	2.20 0.20 0.08 0.50	4.20	Up	160	950	0.11	26,000
light section,	to	to to to to	...	to	to	to	to	to
0.875-in. test bar	3.50	2.40 0.50 0.13 0.80	...	1/2	180	1300	0.16	29,000
Class 25,.....	3.20	2.20 0.15 0.08 0.50	4.08	1/2	172	1800	0.22	26,000
medium section,	to	to to to to	...	to	to	to	to	to
1.2-in. test bar	3.40	2.40 0.40 0.12 0.80	...	1	207	2400	0.28	29,000
Class 25,.....	3.00	1.90 0.15 0.08 0.50	3.82	1	179	6000	...	26,000
heavy section,	to	to to to to	...	and	to	to	...	to
2.0-in. test bar	3.30	2.20 0.25 0.12 0.80	...	up	217	7800	...	30,000
Class 30,.....	3.20	2.10 0.15 0.08 0.50	4.03	1/2	179	1250	...	30,000
light section,	to	to to to to	...	to	to	to	...	to
0.875-in. test bar	3.40	2.30 0.30 0.12 0.80	...	1	228	1500	...	34,500
Class 30,.....	3.10	2.10 0.15	3.92	...	...	...	...	...
medium section,	to	to to to to	...	...	...	...	...	...
1.2-in. test bar	3.30	2.30 0.25	...	...	...	...	...	...
Class 30,.....	2.90	1.70 0.15 0.08 0.45	3.68	1	207	6500	...	30,000
heavy section,	to	to to to to	...	and	to	to	...	to
2.0-in. test bar	3.20	2.10 0.25 0.12 0.70	...	up	228	8200	...	34,500
Class 35,.....	3.10	2.00 0.15 0.08 0.45	3.90	...	179	1150	...	36,000
light section,	to	to to to to	...	to	to	to	...	to
0.875-in. test bar	3.30	2.20 0.30 0.12 0.70	...	1/2	228	1450	...	40,000
Class 35,.....	3.00	1.80 0.15 0.07 0.46	3.77	1/2	207	2300	0.25	35,000
medium section,	to	to to to to	...	to	to	to	to	to
1.2-in. test bar	3.25	2.10 0.25 0.12 0.70	...	1	228	3000	0.35	39,000
Class 35,.....	2.80	1.60 0.10 0.06 0.45	3.54	1	183	7500	0.32	35,000
heavy section,	to	to to to to	...	and	to	to	to	to
2.0-in. test bar	3.10	2.00 0.20 0.12 0.70	...	up	217	9000	0.38	38,000
Class 40,.....	3.00	1.90 0.10 0.07 0.45	3.77	...	212	1275	...	42,000
light section,	to	to to to to	...	to	to	to	...	to
0.875-in. test bar	3.20	2.20 0.25 0.12 0.65	...	1/2	241	1550	...	46,000
Class 40,.....	2.95	1.70 0.10 0.06 0.45	3.65	1/2	207	2500	0.25	40,000
medium section,	to	to to to to	...	to	to	to	to	to
1.2-in. test bar	3.15	2.00 0.20 0.11 0.70	...	1	241	3400	0.35	47,000
Class 40,.....	2.75	1.50 0.07 0.05 0.50	3.42	1	180	8400	0.30	41,000
heavy section,	to	to to to to	...	and	to	to	to	to
2.0-in. test bar	3.00	1.90 0.15 0.12 0.70	...	up	217	9800	0.38	45,000
Class 50,.....	2.90	1.70 0.10 0.06 0.50	3.62	...	228	1600	...	51,000
light section,	to	to to to to	...	to	to	to	...	to
0.875-in. test bar	3.10	2.10 0.20 0.12 0.70	...	1/2	269	1800	...	55,000
Class 50,.....	2.70	1.70 0.10 0.06 0.60	3.45	1/2	228	3000	0.28	50,000
medium section,	to	to to to to	...	to	to	to	to	to
1.2-in. test bar	3.00	2.00 0.20 0.11 0.80	...	1	269	4000	0.34	57,000
Class 50,.....	2.55	1.40 0.07 0.06 0.60	3.20	1	207	10,000	0.38	50,000
heavy section,	to	to to to to	...	and	to	to	to	to
2.0-in. test bar	2.85	1.70 0.15 0.11 0.80	...	up	241	12,500	0.48	54,000
Class 60,.....	2.70	1.90 0.10 0.06 0.50	3.51	...	228	1750	...	60,000
light section,	to	to to to to	...	...	to	to	...	to
0.875-in. test bar	3.00	2.20 0.20 0.12 0.70	...	...	272	2000	...	65,000
Class 60,.....	2.50	1.90 0.05 0.05 0.70	3.37	...	248	3400	0.25	60,000
medium section,	to	to to to to	...	...	to	to	to	to
1.2-in. test bar	2.85	2.10 0.15 0.10 1.00	...	...	290	4500	0.40	65,000
Class 60,.....	2.50	1.20 0.07 0.05 0.50	3.09	...	212	11,500	0.35	60,000
heavy section,	to	to to to to	...	...	to	to	to	to
2.0-in. test bar	2.80	1.50 0.15 0.12 0.80	...	...	248	13,500	0.50	64,000

(a) "Carbon equivalent" is calculated as percentage carbon plus 0.3 times the sum of percentage silicon and phosphorus. Some use carbon plus 1/3 silicon. Data in this table from "Handbook of Cupola Operation", AFS, 1946.

Table 1 Compositions for hot-rolled and cold-rolled plain carbon steel sheet and strip

Grade designation	Composition limits, %					
	C	Mn	P(a)	S(a)	Cu(b)	Si
Hot-rolled sheet and strip: heavy thickness coils (ASTM A 635)						
1006	0.08(a)	0.45(a)	0.040	0.050	0.20(c)	...
1008	0.10(a)	0.50(a)	0.040	0.050	0.20(c)	...
1009	0.15(a)	0.60(a)	0.040	0.050	0.20(c)	...
1010	0.08–0.13	0.30–0.60	0.040	0.050	0.20(c)	...
1012	0.10–0.15	0.30–0.60	0.040	0.050	0.20(c)	...
1015	0.12–0.18	0.30–0.60	0.040	0.050	0.20(c)	...
1016	0.12–0.18	0.60–0.90	0.040	0.050	0.20(c)	...
1017	0.14–0.20	0.30–0.60	0.040	0.050	0.20(c)	...
1018	0.14–0.20	0.60–0.90	0.040	0.050	0.20(c)	...
1019	0.14–0.20	0.70–1.00	0.040	0.050	0.20(c)	...
1020	0.17–0.23	0.30–0.60	0.040	0.050	0.20(c)	...
1021	0.17–0.23	0.60–0.90	0.040	0.050	0.20(c)	...
1022	0.17–0.23	0.70–1.00	0.040	0.050	0.20(c)	...
1023	0.19–0.25	0.30–0.60	0.040	0.050	0.20(c)	...
1524	0.18–0.25	1.30–1.65	0.040	0.050	0.20(c)	...

Table 1 Compositions of registered aluminum casting alloys used to cast chapes

Compositions of alloys used to cast primary ingots are not shown.

Alloy	Products ^(a)	Composition, % ^(b)											
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Sn	Ti	Others	
												Each	Total
201.1	S	0.10	0.15	4.0-5.2	0.20-0.50	0.15-0.55	...	...	...	...	0.15-0.35	0.05 ^(d)	0.10
A201.0	S	0.05	0.10	4.0-5.0	0.20-0.40	0.15-0.35	...	...	...	...	0.15-0.35	0.03 ^(d)	0.10
B201.0	S	0.05	0.05	4.5-5.0	0.20-0.50	0.25-0.35	...	...	...	...	0.15-0.35	0.05 ^(d)	0.15
202.0	S	0.10	0.15	4.0-5.2	0.20-0.8	0.15-0.55	0.30-0.6	...	...	...	0.15-0.35	0.05 ^(d)	0.10
203.0	S	0.30	0.55	4.5-5.5	0.20-0.30	0.10	...	1.3-1.7	0.10	...	0.15-0.25 ^(d)	0.05 ^(d)	0.20
204.0	S, P	0.20	0.35	4.2-5.0	0.10	0.15-0.35	...	0.05	0.10	0.05	0.15-0.30	0.05	0.15
206.0	S, P	0.10	0.15	4.2-5.0	0.20-0.50	0.15-0.35	...	0.05	0.10	0.05	0.15-0.30	0.05	0.15
A206.0	S, P	0.05	0.10	4.2-5.0	0.20-0.50	0.15-0.35	...	0.05	0.10	0.05	0.15-0.30	0.05	0.15
208.0	S, P	2.5-3.5	1.2	3.5-4.5	0.50	0.10	...	0.35	1.0	...	0.25	...	0.50

Table 2 Composition of wrought unalloyed aluminum and wrought aluminum alloys

Grade designation			Composition, wt%														
Aluminum Association	UNS No.	ISO R209 No.	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ga	V	Specified other elements	Ti	Unspecified other elements		Al, minimum
															Each	Total	
1035	...	...	0.35	0.6	0.10	0.05	0.05	...	...	0.10	...	0.05	...	0.03	0.03	...	99.35
1040	A91040	...	0.30	0.50	0.10	0.05	0.05	...	...	0.10	...	0.05	...	0.03	0.03	...	99.40
1045	A91045	...	0.30	0.45	0.10	0.05	0.05	...	...	0.05	...	0.05	...	0.03	0.03	...	99.45
1050	A91050	Al 99.5	0.25	0.40	0.05	0.05	0.05	...	...	0.05	...	0.05	...	0.03	0.03	...	99.50
1060	A91060	Al 99.6	0.25	0.35	0.05	0.03	0.03	...	...	0.05	...	0.05	...	0.03	0.03	...	99.60
1065	A91065	...	0.25	0.30	0.05	0.03	0.03	...	...	0.05	...	0.05	...	0.03	0.03	...	99.65
1070	A91070	Al 99.7	0.20	0.25	0.04	0.03	0.03	...	...	0.04	...	0.05	...	0.03	0.03	...	99.70
1080	A91080	Al 99.8	0.15	0.15	0.03	0.02	0.02	...	...	0.03	0.03	0.05	...	0.03	0.02	...	99.80
1085	A91085	...	0.10	0.12	0.03	0.02	0.02	...	...	0.03	0.03	0.05	...	0.02	0.01	...	99.85
1090	A91090	...	0.07	0.07	0.02	0.01	0.01	...	...	0.03	0.03	0.05	...	0.01	0.01	...	99.90

ARRABIO TIPO FUNDICION

ORIGEN: RUSSO
L.A.B. VERACRUZ

ANALISIS TIPICO

C	4.0	%
Si	2.3	%
Mn	0.6	%
P	0.1	%
S	0.02	%

PESO 10 KG. MAX.

ARRABIO TIPO BASICO

ORIGEN: RUSSO
L.A.B. BROWNSVILLE
LOTES T6675-B y T14001-B.

ANALISIS TIPICO

C	4.15	%
Si	0.84	%
Mn	0.037	%
P	0.049	%
S	0.025	%

PESO 12 KG. MAX.

CARBON COKE ABC

ORIGEN ALABAMA
LAB. NUEVO LAREDO

VM	0.38	%
FC	93.06	%
CENIZA	6.56	%
S	0.58	%

Tamaño: 4" x 6"

FERROSILICIO

ORIGEN VENEZUELA
LAB. BROWNSVILLE

Si	75.96	%
Al	1.49	%
C	0.110	%
S	0.003	%
P	0.26	%

Tamaño: 2" x 4"

Y viene en super sacos de 1.5 T.M.

ORIGEN RUSSO.

L.A.B. BROWNSVILLE.
LOTES 6272-F y 13854-F

ANALISIS TIPICO

C	3.94	%
Si	2.20	%
Mn	0.64	%
P	0.091	%
S	0.012	%

PESO 12 KG. MAX.

ORIGEN: BRASIL

L.A.B. BROWNSVILLE.
LOTE: 4255

ANALISIS QUIMICO

C	4.05	%
Si	0.3	%
Mn	0.5	%
P	0.07	%
S	0.02	%

PESO 12 KG. MAX.

ORIGEN RUSSO

LAB. VERACRUZ

Si	74.19	%
Al	1.38	%
C	0.08	%
S	0.002	%
P	0.03	%

Tamaño: 0.5" x 3.5"

Y viene en super sacos de 1.5 T.M.



METALS & ALLOYS

SILICON

Silicon Metal	% Si	% Fe	% Ca	% Al
Regular	98.25 Min	.50 Max	.07 Max	.75 Max
	98.00 Min	1.00 Max	.07 Max	.75 Max
	96.75 Min	1.50 Max	.15 Max	.75 Max
High Calcium	97.50 Min	1.00 Max	.40 Max	.75 Max
	96.75 Min	1.50 Max	.40 Max	.75 Max
Chemical	98.00 Min	1.00 Max	.07 Max	.50 Max

Ferrosilicon	% Si	% Al	% Ca	Other
50% Regular	47-51	1.25 Max	—	—
50% High Purity	47-51	.10 Max	.10 Max	C .05 Max
50% Low Aluminum	47-51	.50 Max	.20 Max	—
75% Regular	74-79	1.50 Max	—	—
75% Low Aluminum	74-79	.50 Max	.50 Max	—
75% with Boron	74-79	1.25 Max	—	B .05 Min

MANGANESE

Electrolytic Manganese	% Mn	% C	% Si	% S
	99.95	.01	.001	.03

Ferromanganese	% Mn	% C	% Si	% P
Std. High Carbon	76-79	7.5 Max	1.2 Max	.50 Max
Low Phosphorus	77-79	7.5 Max	1.2 Max	.10 Max
Medium Carbon	80-85	1.5 Max	1.5 Max	.50 Max
Low Carbon	85-90	.75 Max	2.0 Max	.20 Max
Nitrided (4.25% N Min)	75% Min	1.5 Max	1.5 Max	.20 Max

Silicomanganese	% Mn	% C	% Si	% P
	65-68	2.0 Max	16-18.50	.20 Max

CHROMIUM

Electrolytic Chromium Metal	% Cr
	99.9

Ferrochrome	% Cr	% C	% Si
High Carbon	62-72	4-9.5	5.0 Max
Low Carbon (.025% Grade)	65-72	.025 Max	1.0 Max
Low Carbon (.05 C Grade)	65-72	.05 Max	1.0 Max
Low Carbon (.10 C Grade)	65-72	.10 Max	1.0 Max
Low Carbon (.15 C Grade)	65-72	.15 Max	1.0 Max

SPECIALTY ALLOYS

Ferrovanadium	% V	% Al	% Si	% C	% S	% P
80% Grade	78-82	1.5 Max	1.0 Max	.75 Max	.05 Max	.05 Max

Molybdenum	% Mo	% Cu	% Si	% S	% P
Ferromolybdenum	60-65	.5 Max	1.0 Max	.15 Max	.05 Max
Molybdenum Oxide					
Powder	57 Min	.5 Max	—	.10 Max	.05 Max
Brigette	57 Min	.5 Max	—	.15 Max	.05 Max

Ferrocolumbium	% Co	% Al	% Si	% C	% S	% P
	10-70	3.0 Max	4.0 Max	.5 Max	.10 Max	.30 Max

Ferrophosphorus	% P	% Si	% Mn	% C		
	22-26	1.5-4.0	1.5-2.5	.25 Max		

OTHER METALS & ALLOYS

Antimony	% Sb	% Ag	% Fe
	99.0 Min	.05	.10

Copper Chops	% Cu		
	99.0		

Tin Shot/Bars	% Sn		
	99.0		

Tungsten Metal	% W		
	99.9		

Ferrotungsten	% W	% Fe	
	80.0	20.0	

Silicon Carbide	% SiC	% Free C	% R ₂ O ₃
Metallurgical 90% Grade	88-92	1-3	5.0 Max

Iron Pyrite	% S	% Fe	% SiO ₂
	47	42	6

Fluorspar	% CaF ₂	% SiO ₂	% CaCO ₃
	88-91	3-5	4-5

PIG IRON

	% C	% Si	% Mn	% P	% S
Basic Grade	3.5-4.5	1.5 Max	1.0 Max	.10 Max	.05 Max
Foundry Grade	3.5-4.5	2.5-3.0	1.0 Max	.10 Max	.05 Max
Nodular Grade	3.5-4.5	.50 Max	.05 Max	.05 Max	.02 Max



FOUNDRY ALLOYS

INOCULANTS

50% Ferrosilicon Foundry Grade	75% Ferrosilicon Foundry Grade	HW-26
Si 47-51%	Si 74-79%	Si 70-77%
Al 60-1.25%	Al .80-1.50%	Al 3.0-4.5%
Ca 50-1.50%	Ca .50-1.50%	Ca .50-1.50%
HW Cubes	INOCARB*	GRAFIDIN (Inolate 10)*
Si 74-79%	Si 32%	Si 64%
Al .80-1.50%	Al .7%	Al 1.3%
Ca .70-1.50%	Ca .5%	Ca 2.5%
Available in 20-30 gram, 30-40 gram, 50-60 gram and other sizes in 10 gram increments.	Ba 4.5%	Mn 9%
	C 50%	Ba 4.5%
LMC (Inolate 196)*	HW-5	INOBAR (Inolate 20)*
Si 66%	Si 70-77%	Si 64%
Al .8%	Al .80-1.50%	Al 1.3%
Ca 1.7%	Ca .80-1.50%	Ca 1%
Ba .8%	Ba 1.5-2.5%	Ba 9%
HW 50 SR	INOSTRONG (Inolate 30)*	SPHERIX (Inolate 40)*
Si 47-51%	Si 75%	Si 72%
Al 60% Max	Al .5%	Al 9%
Ca .10% Max	Ca .1%	Ca 1.5%
Sr .70-1.10%	Sr .85%	Bi 1%
		TRE .5%
INOCAST 125 (Inolate 190)*	ZIRCOGRAF (Inolate 50)*	ZL-80 (Inolate 60)*
Si 65%	Si 66%	Si 75%
Al .9%	Al 1.3%	Al 1.4%
Ca 1.1%	Ca 1.5%	Ca 2.5%
Mn 3.5%	Mn 6%	Zr 1.6%
Zr 4%	Zr 6%	
Ba .2%		
HW Ti Cl	HW Ti S	HW 50D
Si 50-55%	Si 52-99%	Si 46-50%
Al 9-1.20%	Al .95-1.35%	Al 1.25% Max
Ca 5-1.50%	Ca 5.5-8.50%	Ca .70-1.25%
Ti 10.0-12.0%	Ti 7.0-12.0%	Mg 1.0-1.50%
MOLDINOC 65* In Mold Inserts	MOLDINOC 75* In Mold Inserts	
Si 66%	Si 77%	
Al 1%	Al .8%	
Ca 1%	Ca .4%	
Mn .25% Max	Mn .25% Max	
Ba .15% Max	Ba .15% Max	
MOLDINOC 65 available in 25, 50, 70, 90 or 100 gram sizes.	MOLDINOC 75 available in 20, 40, 60, 80 or 150 gram sizes.	

MAGNESIUM FERROSILICON TREATMENT ALLOYS

Rare Earth Free Grades	% Mg	% Si	% Ca	% Al	
HW-MAG 3	2.90-3.40	44.0-48.0	.80-1.35	1.25 Max.	
HW-MAG 5	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	
MAG 910*	9.00	46.0	1.20	0.80	
Cerium Bearing Grades	% Mg	% Si	% Ca	% Al	% Ce
HW-MAG 5L	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	.30-.40
HW-MAG 5M	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	.45-.70
HW-MAG 5MHP	5.50-6.50	44.0-48.0	.30 Max.	.30 Max.	.45-.70
HW-MAG 5H	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	.90-1.25
Blended Rare Earth Grades	% Mg	% Si	% Ca	% Al	Total Rare Earth
HW-MAG 3LA	3.00-3.80	44.0-48.0	.80-1.35	1.25 Max.	1.50-2.20
HW-MAG 3LAFT	3.00-3.80	44.0-48.0	.80-1.35	1.25 Max.	1.30-1.80
HW-MAG 5LA	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	.90-.85
HW-MAG 5LD	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	.75-1.10
HW-MAG 5LC	5.50-6.50	44.0-48.0	.80-1.35	1.25 Max.	1.25-1.75
Calcium Modified Grades	% Mg	% Si	% Ca	% Al	Other
HW-MAG 4LBHC	4.5-5.5	44.0-48.0	1.80-2.25	1.25 Max.	TRE .50-.85
HW-MAG 5LBHC	5.5-6.5	44.0-48.0	1.80-2.25	1.25 Max.	TRE .50-.85
In Mold Treatment	% Mg	% Si	% Ca	% Al	Other
SDMAP*	5.7	46.0	.40	1.0	TRE .40

*Trademark of Pechiney Electrometallurgie

Inoculants are available in standard ladle sizes, injection sizes or in cored wire form.

Inolate is a designation for late inoculation size.

Magnesium Ferrosilicon treatment alloys are available in standard industry sizes including stream treatment applications.



METALS & ALLOYS

INCO NICKEL PRODUCTS

	% Ni	% C	% Fe	Other
Electrolytic Nickel	99.8 Min	.01	.002	Cu .005
4" x 4" Cathodes				
2" x 2" Cathodes				
Nickel Briquettes	99.9 Min	.01	.015	Cu .01
1-1/2" x 5/8"				
Nickel Pellets*	99.9 Min	.01	.002	Cu .005
1/4" x 1/2"				
F Nickel Shot*	91-93	2-4	2-3	5-5.5 Si
Nickel Oxide Sinter*	74-76	—	3-5	Cu .65-90 Co .8-1.0 Balance Oxygen
40 x 65 Mesh				
Nickel Powder*	99.7 Min	.1	.01	.15 Oxygen
Type 123				
Inconel Alloy 1*	82-86	1.0	.05	Mg 14-16
4" x 1/4"				
Inconel Alloy 3LC*	95-96	.025	.05	Mg 4-6
3lb. pig				
Inconel Alloy 4*	58-62	1.6-1.8	.34	Mg 4-5
3lb. pig				
Inconel Alloy 10*	93-95	.02-.04	.02	Ca 4.5-5.5
3lb. pig				

*Trademark of the INCO family of companies.

BRIQUETTED ALLOYS

Silicon	Alloy Content	Total Weight
Si B4-50	2 lbs. Silicon	4 lbs.
Si B6-50	3 lbs. Silicon	6 lbs.
Si B20-50	10 lbs. Silicon	20 lbs.-segmented
Si B40-50	20 lbs. Silicon	40 lbs.
Manganese	Alloy Content	Total Weight
Mn B3	2 lbs. Manganese	3 lbs.
Mn B10	6.5 lbs. Manganese	10 lbs.
Mn B15	10 lbs. Manganese	15 lbs.-segmented
Mn B30	20 lbs. Manganese	30 lbs.-segmented
Chromium	Alloy Content	Total Weight
Cr B8	45% Chromium	8 lbs.
FeCr/Si15	25% Chromium	13 lbs.-segmented
	15% Silicon	

GAIT ALLOYS

Boron-Titanium

	% B	% Ti	% Al	% Zr	% Si	% Mn	% Fe
Bortal 5*	0.5	20.0	13.0	4.0	5.0	8.0	Balance
Bortal X*	2.25	47.0	8.0	5.0	4.0	6.0	Balance

*Trademark of Gait Alloys, Inc.

Ferroaluminum

	% Al	% Si	% Mn	% Cu	% C	% Fe	
65% Grade	65.0-68.0	0.6 Max	0.5 Max	0.2 Max	0.1 Max	Balance	
40% Grade	38.0-42.00	0.6 Max	0.5 Max	0.2 Max	0.1 Max	Balance	
35% Grade	30.0-33.0	0.6 Max	0.5 Max	0.2 Max	0.1 Max	Balance	

40% Ferrotitanium

	% Ti	% Al	% V	% Si	% C	% S	% N ₂
Std. Grade	38.0-43.0	2.65 Max	1.75 Max	0.75 Max	0.50 Max	0.04 Max	0.30 Max
HP Grade	38.0-43.0	0.40 Max	0.20 Max	0.10 Max	0.10 Max	0.02 Max	0.25 Max

70% Ferrotitanium

	% Ti	% Al	% V	% Si	% C	% S	% N ₂
Std. Grade (LL)	68.0-73.0	5.00 Max	3.00 Max	0.25 Max	0.20 Max	0.02 Max	0.40 Max
HP Grade	68.0-73.0	0.50 Max	0.25 Max	0.10 Max	0.15 Max	0.02 Max	0.30 Max

Titanium Pucks

	% Ti	% Al	% V	% C	% Sn	% Cr	% Ni
Ti-Pucks 85	85.0-88.0	6.5 Max	4.5 Max	0.5 Max	2.5 Max	1.0 Max	1.0 Max
Ti-Pucks 90	87.0 Min	8.0 Max	4.5 Max	0.15 Max	0.25 Max	1.5 Max	1.5 Max

Silicon-Titanium

	% Si	% Ti	% Fe				
STTi 50	47.0-50.0	47.0-50.0	Balance				

Powdered Alloys

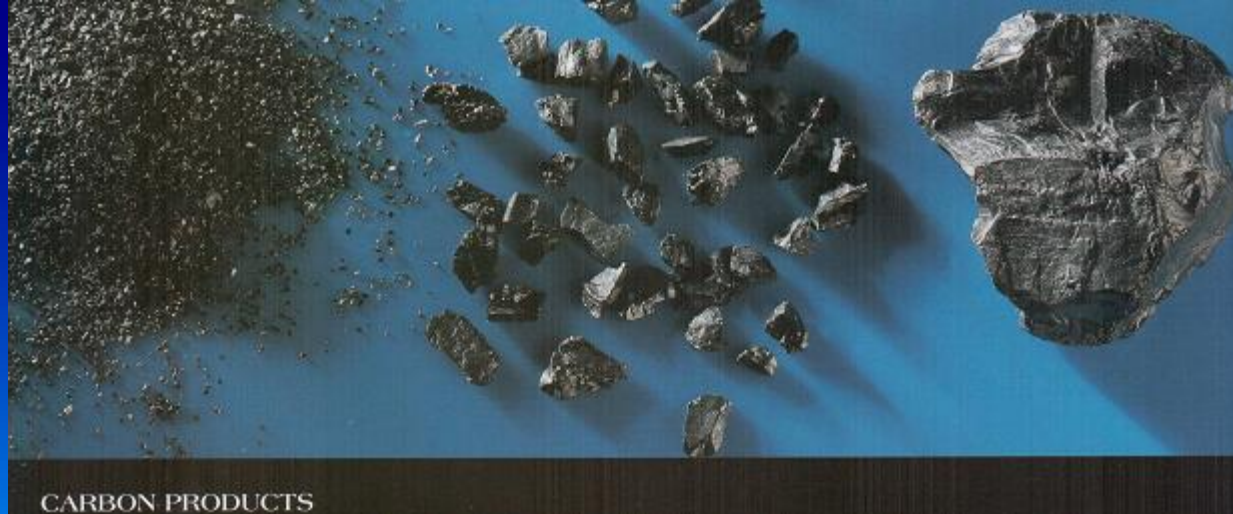
- Aluminum
- Boron

Specialty Alloys

- Ferroboron
- Ferrosilicon/Zirconium
- Nickel Titanium
- Nickel Zirconium

Silicon Carbide	Alloy Content	Total Weight
Si C5	65%/3.25 lbs. Si C	5 lbs.
Si C15	65%/9.75 lbs. Si C	15 lbs.-segmented
Si C30	65%/19.5 lbs. Si C	30 lbs.
Phosphorus	Alloy Content	Total Weight
FeP-3 (Foundry)	16.0% P/2.5% Si	3.0 lbs.
FeP (Steel)	22.0% P/No Si	Pillow Briquette
Ilmenite	Alloy Content	Total Weight
IL-25	8 lbs. TiO ₂	25 lbs.-segmented
IL-8	2.5 lbs. TiO ₂	8 lbs.-segmented
IL-3	1.0 lb. TiO ₂	3 lbs.
Fluorspar	Alloy Content	Total Weight
	75% Fluorspar	5 lbs.

Flowable bricks of all the above alloys can be produced to meet specific requirements.



ANTHRACITE COAL

Typical Analysis

Product	Size	% Moisture	% Ash (Dry Basis)	% Volatile (Dry Basis)	% Fixed Carbon (Dry Basis)	% Sulfur (Dry Basis)
Egg	2-7/16" x 3-1/4"	5.0	8-10	4.0-4.5	84-88	.55
Stove	2-7/16" x 1-5/8"	5.0	9-11	4.0-4.5	84-88	.55
Nut	1-5/8" x 13/16"	5.0	9-11	4.0-4.5	84-88	.55
Pea	13/16" x 9/16"	5.0	9-11	4.0-4.5	84-88	.55
Buckwheat	9/16" x 5/16"	5.0	10-12	4.0-4.5	84-88	.55
Rice	5/16" x 3/16"	5.0	11-13	4.0-4.5	84-88	.55
Barley	3/16" x 3/32"	8.0	11-13	4.5-5.0	82-85	.60
Buckwheat #4	3/64" x 3/32"	9.0	12-14	4.5-5.0	80-83	.60
Buckwheat #5	3/64" x 0	10.0	13-15	4.5-5.0	80-83	.60

Anthracite products are also available dried to less than 1% moisture. The above sizes may be supplied blended as needed to meet customer requirements.

METALLURGICAL COKE

Screened By-Product Coke

Typical Analysis

Product	Size	% Moisture	% Ash (Dry Basis)	% Volatile (Dry Basis)	% Fixed Carbon (Dry Basis)	% Sulfur (Dry Basis)
Smelter Coke	4" x 2"	6-8	6-8	1-1.5	91.5-93	.65
Blast Furnace Coke	4" x 1"	5-10	7-8	1.5-2	90-91.5	.75
Nut Coke	1 1/2" x 3/4"	10-13	8-10	1-2	88-91	.6-8
Buckwheat Coke	3/4" x 1/4"	10-13	9-11	1-2	87-90	.6-8
Coke Breeze	1/4" x 0	10-13	9-13	1-3	84-90	.6-8

By-product coke is screened and processed in Hickman, Williams & Company owned facilities.



TECHNI-CARB CARBON PRODUCTS

Dried Metallurgical Coke

Typical Analysis

Product	Size	% Moisture	% Ash	% Volatile	% Fixed Carbon	% Sulfur
Buckwheat	3/4" x 1/4"	5.0 Max.	10-13	1.6-2.5	86-88	.60-.70
Coarse Grade	3/8" x 10 Mesh	1.5 Max.	10-13	1.6-2.5	86-88	.60-.75
Fine Grade	8 Mesh x 0	1.5 Max.	10-13	2.0-2.5	85-88	.60-.75
Regular Grade	3/8" x 100 Mesh	1.5 Max.	10-13	2.0-2.5	85-88	.60-.75
Extra Fine Grade	40 Mesh x 200 Mesh	1.0 Max.	10-13	2.0-2.5	85-88	.60-.75
Flour Grade	200 Mesh x 0	1.0 Max.	16-22	6.0-8.0	70-75	.70-1.25

Techni-Carb products are available in bulk for pneumatic or dump truck delivery. Packaging is also available in 50 lb. bags or bulk bags.

Techni-Carb products are manufactured and sold exclusively by Hickman, Williams & Company.

BLACK DIAMOND DIA CARB PRODUCTS

Calcined Petroleum Coke

Typical Analysis

Product	Size	% Moisture	% Ash	% Volatile	% Fixed Carbon	% Sulfur
Dia Carb 45-55	3/8" x 100 Mesh	.05 Max.	.30 Max.	.50 Max.	99.20 Min.	.20-.30
Dia Carb 044	20 Mesh x 100 Mesh	.05 Max.	.30 Max.	.50 Max.	99.20 Min.	.40-.60
Dia Carb G	3/8" x 100 Mesh	.05 Max.	5.0 Max.	1.75 Max.	93.00 Min.	.75-.95
Dia Carb 1	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	1.0-1.2
Dia Carb 15	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	1.4-1.6
Dia Carb 4	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	1.8-2.0
Dia Carb 4AN	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	2.1-2.3
Dia Carb 4A	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	2.6-2.8
Dia Carb 7F	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	.75 Max.	98.50 Min.	3.4-4.0
Dia Carb 7	4 Mesh x 100 Mesh	.05 Max.	.75 Max.	1.0 Max.	98.00 Min.	4.5-4.8

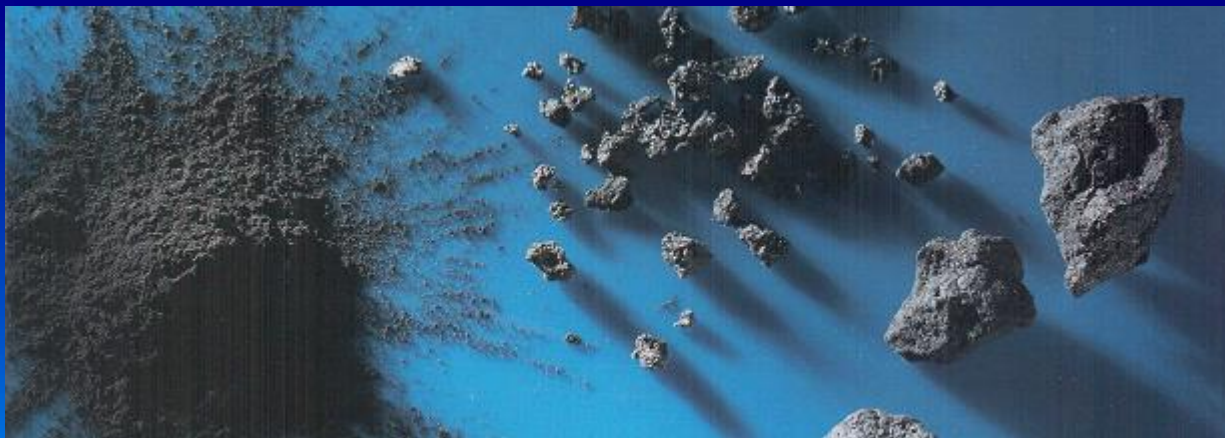
Dia Carb Products are available in 50 lb. bags or bulk bags. Black Diamond Dia Carb Products are manufactured exclusively by Black Products Division of Hickman, Williams & Co.

GRAPHITE

Techni-Graph Synthetic Graphite

Product	Size	% Moisture	% Ash	% Volatile	% Fixed Carbon	% Sulfur
Techni-Graph 99	3/8" x 0, 20 Mesh x 0	1 Max.	.5	.5	99.0 min.	.05 Max.

Available in 50 lb. bags and bulk bags.



SUPER G®

Product	Size	% Moisture	% Ash	% Volatile	% Fixed Carbon	% Sulfur
Super G 9165	3/8" x 65 Mesh	.35 Max.	.5 Max.	.2 Max.	99.5 Min.	.1 Max.
Super G 9130	3/8" x 65 Mesh	.4 Max.	.5 Max.	.25 Max.	99.5 Min.	.18 Max.

Super G products can be custom blended to meet customer sulfur requirements.

*Trademark of Superior Graphite Co.

DESULCO®

% Moisture	% Ash	% Volatile	% Fixed Carbon	% Sulfur	% Nitrogen	% Hydrogen	% Oxygen
0.2 Max.	0.5 Max.	0.2 Max.	99.7 Min.	.03 Max.	42 ppm	10 ppm	128 ppm

Grade	Size
9001	3/8" x 65 Mesh
9005	3/8" x 12 Mesh
9012	6 Mesh x 28 Mesh
9018	20 Mesh x 80 Mesh

Available in 50 lb. bags and bulk bags. The purest form of carbon additive available.

*Trademark of Superior Graphite Co.

CARBON PRODUCTS FOR ALL APPLICATIONS:

- Foundry
- Steel
- Charge Carbon
- Ladle Addition
- Slag Foaming
- Cupola Tuyere Injection for Superior Carbon Control
- Ladle Furnace Desulco® Injection as an Economical Alternative to Wire Feeding

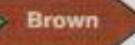
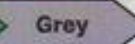
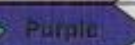
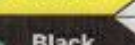
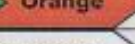
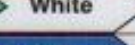
FERROALEACIONES

NOMBRE	ELEMENTO	C % Min.	Si % Max.	S % Max.	TAMAÑO 90% Min.
ALUMINIO	Al 95.00	-	-	-	BARRA 1 KG, GRANALLA, 1/2 ESFERA
ANTIMONIO	Sb 99.20	-	-	-	LINGOTES
CALCIO SILICIO	Ca 28.00	0.554	70.00	0.027	(7x20) y (8x0)
COBALTO	Co 99.0	-	-	-	BARRA 18-25 KG, POLVO
COBRE CATODICO	Cu 99.99	-	-	-	CATODOS
CROMO ELECTROLITICO	Cr 99.00	-	-	-	1½" x 10 Mesh
ESTAÑO	Sn 99.80	-	-	-	LINGOTES, GRANALLA Y BARRA-1 KG
ESTAÑO GRADO A	Sn 99.85	-	-	-	LINGOTES
FERROBORO	B 17.5	0.05	3.00	0.030	2" x D
FERRONIÓBIO (FERROCOLUMBIO)	Nb 65.0	0.07	1.30	0.008	10 x 30 mm
FERROCROMO ALTO CARBON	Cr 62.0	7.00	3.00	0.040	3" x 1", 2" X ½", 4" X2", FINOS
FERROCROMO BAJO CARBON	Cr 65.0	0.05	0.75	0.025	2" x 1/2", 3" X ½"
FERROMANGANESO ALTO CARBON	Mn 72.00	1.40	0.05	0.007	3" x ½", 4" X 2", 3/8 X 12M
FERROMANGANESO MEDIO CARBON	Mn 80.0	1.40	0.05	0.007	3" x ½"
FERROMOLIBDENO	Mo 60.0	0.04	1.50	0.050	(-3") y (-1½"x ½"), FINOS
FERROFOSFORO	P 23.0	-	3.20	-	10 x 50 mm
FERROSILICIO 75%	Si 75.0	0.05	-	0.005	(25 x 75 mm), (10 X 50mm) (3/8" x 12 Mesh
FERROSILICIO-ULTRA BAJO ALUMINIO	Si 75.0	0.10	0.10	0.003	Al 0.05 25 X 75mm
FERROSILICIO MAGNESIO	Si 43.0	0.05	-	0.005	Mg 8.41 3/4" x 5 Mesh
FERROSILICIO ZIRCONIO	Si 51.98	0.15	-	-	Zr 35.02 3/8" x 12 Mesh
FERROTITANIO	Ti 68.0	0.15	0.20	0.05	Al 5.00 (2" x ½") y (3/4" x D)
FERROTUNGSTENO	W 75.0	0.60	1.00	0.10	10 x 125 mm, ½" x D
FERROVANADIO	V 80.0	1.00	0.35	0.10	Al 1.00 2" x D, 2" X 1/2"
FOSFURO DE COBRE	Cu 85.0	-	-	-	P 15.00 WAFFLE / GRANALLA
FERROBORO	B 18.0	0.50	1.00	0.01	P 0.05 POLVO, 15 X 75
INOCULANTE	Mn10.0	0.06	63.5	-	Ca 2.00 3/8" x 8 Mesh
MAGNESIO PURO	Mg 99.5	-	-	-	LINGOTE
MANGANESO ELECTROLITICO	Mn 99.0	0.01	0.003	.030	HOJUELAS
NIQUEL	Ni 99.9	0.002	N/A	0.001	(4"x 4") , (1"x 1"), PELLETS, BRIQUETA
OXIDO FERRICO (HEMATITA)	Fe ₂ O ₃ 97.0	0.10	0.20	-	Cl 0.30 POLVO
SILICIO METALICO	Si 99.0	-	-	-	10 x 100 mm
SILICO MANGANESO	Mn 65.0	2.00	15.0	0.03	3" x ½"
TITANIO BORO ALUMINIO 5/1	Ti 4.5	-	0.20	-	VARILLA
TRIOXIDO DE MOLIBDENO	Mo 58.0	0.05	-	0.05	POLVO
ZINC	Zn 99.5	-	-	-	SEMIESFERA, LINGOTE
BENTONITA SODICA	RESIST. EN VERDE 12.0 PSI HINCH 26 CC GELACION 40 SEG				200 Mesh
FLUORITA GRADO METALURGICO	CaF ₂ 80.0	CaCO ₃ 7.0	SiO ₂ 7.0		½" x 1/8"
FLUORITA GRADO ACIDO (SECO)	CaF ₂ 97.0	CaCO ₃ 1.0	SiO ₂ 1.0		100 x 325 Mesh
PIRITA	Pureza (FeS ₂) 99 % Min, Hierro 45-47%, Azufre 53-55 %				- 200 Mesh

PRODUCTOS DE CARBON

NOMBRE	CARBON FIJO % Min.	M. VOLATIL % Max.	CENIZA % Max.	AZUFRE % Max.	TAMAÑO 90% Min.
CARBOOSTER 50 LS	98.50	0.50	0.50	1.00	3/8" x 12 Mesh
CARBOOSTER XS	98.00	1.20	0.50	4.00	3/8" x 12 Mesh
CARBOOSTER XLS	98.00	1.00	0.50	0.03	3/8" x 60 Mesh
CARBOOSTER AIMCHG	92.00	3.00	5.00	1.00	3" x 1/4"
CARBOOSTER AIMINS	96.00	2.40	1.20	1.10	10 x 200 Mesh
CARBON MARINO	92.00	35.00	-	-	70 Mesh
ANTRACITA	80.00	4.00	16.0	0.65	3" x 1/2" y 1/4" x 0
COQUE METALURGICO (CBA)	84.00	2.00	13.0	0.60	3" x 6"

Master Alloys for the Aluminium Industry

Colour Code	Product	Name	Percentage of Alloying Element	Available as						
				10 mm Rod	Cut Rod	0,5 kg ContiCast	2,5 kg ContiCast	7 kg Waffle	Others/ Remarks	
Grain Refiners										
Green 	Brown	Titanium-Boron	AlTiB	3% Ti-1% B	☑	☑	☑	☑	☑	
Green 	Grey	Titanium-Boron	AlTiB	3% Ti-0.4% B	☑	☑	☑	☑		
Green 	Purple	Titanium-Boron	AlTiB	3% Ti-0.2% B	☑	☑	☑	☑		
Green 		Titanium-Boron	AlTiB	5% Ti-1% B	☑	☑	☑	☑	☑	
Green 	Yellow	Titanium-Boron	AlTiB	5% Ti-0.6% B	☑	☑	☑	☑		
Green 	Black	Titanium-Boron	AlTiB	5% Ti-0.2% B	☑	☑	☑	☑	☑	
Green 	Red	Titanium-Boron	AlTiB	5% Ti-0.1% B	☑	☑	☑	☑		
Green 	Orange	Titanium-Boron	AlTiB	6% Ti-0.4% B	☑	☑	☑	☑		
Green 	White	Titanium-Boron	AlTiB	10% Ti-1% B					☑	
Green 	Dark Blue	Titanium-Boron	AlTiB	10% Ti-0.4% B	☑	☑	☑	☑		

Hardeners

No Code	Antimony	AlSb	8 or 16%					✓	
Purple	Yellow	AlBi	3 or 6%					✓	
No Code	Cadmium	AlCd	10%					✓	
Orange	White	AlCa	10%					✓	
Purple	Chromium	AlCr	5, 10, or 20%					✓	
Light Blue	Orange	AlCo	10%					✓	
Orange	Copper	AlCu	20, 33, 50 or 54%					✓	✓
Orange	Black	AlFe	5, 10, 15, 20, 25 or 45%	✓				✓	Splatter
No Code	Lithium	AlLi	5%					✓	
Purple	White	AlMg	10, 20, 25, or 50%					✓	✓
Brown	Manganese	AlMn	10, 20, 25, 30 or 60%					✓	Splatter
Grey	Nickel	AlNi	10, 20, 25 or 50%	✓				✓	✓
White	Silicon	AlSi	20, 22, 25, 30 or 50%	✓				✓	
White	Black	AlMgSi	20% Si - 20% Mg					✓	
Black	Vanadium	AlV	5 or 10%					✓	
Red	Titanium	AlTi	6%	✓	✓	✓	✓	✓	
Red	Black	AlTi	10%	✓	✓	✓	✓	✓	
Dark Blue	Zirconium	AlZr	6 or 10%					✓	

Special Alloys

Red	Yellow	Beryllium	AlBe	5%						✓
Yellow	Boron	AlB	3, 4 or 5%	✓	✓	✓	✓	✓		
No Code	Molybdenum	AlMo	10%					✓		
No Code	Silver	AlAg	10%					✓		
Light Blue	Strontium	AlSr	3.5, 5, 10 or 15%	✓	✓			✓		
No Code	Yttrium	AlY	8%					✓		

Silicon Containing Alloys

	% Si	% Al	% Ca	OTHER
50% FeSi - Reg. Grade	47-51	1.25 max.	0.30 max.	-----
50% FeSi - Low Al	47-51	0.50 max.	0.20 max.	-----
50% FeSi - High Purity	47-51	0.10 max.	0.10 max.	0.03 max. Ti
75% FeSi - Reg. Grade	74-79	1.50 max.	0.50 max.	-----
75% FeSi - Low C	74-79	-----	-----	0.02 max. C
75% FeSi - Low Al	74-79	0.50 max.	0.30 max.	-----
75% FeSi - High Purity	74-79	0.10 max.	0.10 max.	0.040 max. Ti

APPLICATION: Ferrosilicon is used primarily as a deoxidizer. It readily combines with the oxygen in the molten metal. Sometimes used as a degasifier because of its affinity for undesirable gases. Used as a source of silicon in cast iron.

Magnesium Containing Alloys

	% Mg	% Si*	% Ca	% Ce	% T.R.E.	% AL**
Noduloy ®3	3.5-4.2	43-48	0.8-1.3	-----	-----	1.2 max.
Noduloy 5	5.5-6.5	43-48	0.8-1.3	-----	-----	1.2 max.
Noduloy 9	8.5-10	43-48	1.0-1.5	-----	-----	1.2 max.
Noduloy 5LC	5.5-6.5	43-48	0.8-1.3	0.3-0.4	-----	1.2 max.
Noduloy 5C	5.5-6.5	43-48	0.8-1.3	0.5-0.75	-----	1.2 max.
Noduloy 5C1	5.5-6.5	43-48	0.8-1.3	0.9-1.2	-----	1.2 max.
Noduloy 3R	3.5-4.2	43-48	0.8-1.3	[0.9-1.2]	1.5-2.0	1.2 max.
Noduloy 5R-1	5.5-6.5	43-48	0.8-1.3	0.3-0.45	[0.5-0.85]	1.2 max.
Noduloy 5R-2	5.5-6.5	43-48	0.8-1.3	0.45-0.6	[0.75-1.15]	1.2 max.
Noduloy 5R-3	5.5-6.5	43-48	0.8-1.3	0.85-1.0	[1.45-2.0]	1.2 max.
Noduloy 5R-2+	6.0-7.0	43-46	1.7-2.3	0.45-0.6	[0.75-1.15]	1.2 max.
Noduloy 9R	8.5-10	43-48	0.8-1.3	0.35-0.5	[0.6-1.0]	1.2 max.
Noduloy 3R	3.5-4.2	43-48	0.8-1.3	[0.9-1.2]	1.5-2.0	1.2 max.

[] = Typical Range

*For certain Noduloy-Alloys a silicon level of 40-42% available. More utilization of returns possible, because of the lower silicon-addition during the magnesium treatment.

**For certain Noduloy-Alloys 0.5% maximum aluminum available.

High calcium, high magnesium alloys are available to minimize alloy addition; also, low aluminum and low calcium alloys are available for pressure pouring applications.

Inoculant

	% Si	% Al	% Ca	% Ba	% Ce	% T.R.E.	% Ti	% Mn	% Fe
Calsifer®50	46-50	0.5-1.4	0.6-1.0	-----	-----	-----	----	----	-----
Calsifer 75	74-79	0.75-1.5	0.5-1.0 1.0-1.5	-----	-----	-----	----	----	-----

APPLICATION: Specially sized and of proper composition for the inoculation of gray and ductile cast irons.

Inoculoy®63	60-65	0.8-1.5	1.5-3.0	4-6	-----	-----	----	7-12	-----
SB5	65-72	0.8-1.5	0.8-1.5	1.5-2.5	-----	-----	----	----	-----

APPLICATION: Powerful inoculant for gray and ductile cast irons. High efficiency permits use of small additions. Provides excellent chill reduction in gray cast irons.

Inoculant (cont.)

	% Si	% Al	% Ca	% Ba	% Ce	% T.R.E.	% Ti	% Mn	% Fe
InocuChrome™	6-11	0.5 max.	0.5 max.	-----	-----	2-3	-----	-----	-----

APPLICATION: (46-50% Chrome) Inoculant for gray cast irons for increasing mechanical properties.

CFS - 10®	36-40	-----	-----	-----	9-11	10.5-15.0	-----	-----	-----
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APPLICATION: For reducing chill and providing proper graphite structure for optimum mechanical properties in gray cast iron. A source of cerium and rare earths for gray and ductile cast iron. Economical and flexible source of cerium for the production of ductile iron. Used in conjunction with magnesium ferrosilicon.

	% Si	% Al	% Ca	% Ba	% Ce	% T.R.E.	% Ti	% Mn	% Sr
Graphidox®	50-55	-----	5-7	-----	-----	-----	9-11	-----	-----

APPLICATION: Highly effective in supplementary deoxidation of steel for castings. Improves quality of steel castings and increases yield strength, ductility, and low temperature impact toughness properties.

Low Calcium Graphidox®	50-55	-----	0.5-1.5	-----	-----	-----	9-11	-----	-----
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APPLICATION: Highly effective proprietary inoculant designed for effective, economical inoculation of both gray cast iron and compacted graphite irons. This titanium bearing ferroalloy is highly efficient as both a graphitizer and deoxidizer. In addition, titanium in LOW CALCIUM GRAPHIDOX reacts with nitrogen in iron to reduce chances of nitrogen porosity.

SRF-50	44-48	0.5 max.	0.10 max.	-----	-----	-----	-----	-----	0.8-1.2
SRF-75	74-79	0.5 max.	0.10 max.	-----	-----	-----	-----	-----	0.8-1.2

APPLICATION: Proprietary inoculant containing strontium, the most potent element for reducing chill and promoting type A graphite structure in gray iron. Offer good machinability while keeping tensile strength and hardness to a minimum.

*Lower silicon values are possible with sizes of 8M and finer.

ESM Desulfurizers

X-1	Calcium oxide used with continuous porous plug cupola runner application.
S-1	Calcium fluoride used with continuous porous plug cupola runner applications.
LoSul B-1050	Bagged calcium oxide base product used in foundry ladle desulfurization applications.

APPLICATION: Environmentally acceptable alternatives to calcium carbide for the desulfurization of cast iron in the production of ductile iron; can be applied to continuous or batch processing; cupola or electric base iron; sulfur levels below .010% are obtainable.

Specialty Metals and Alloys

	% Cr	% Fe	% Si	% Al	% C	% S	% O ₂	% N ₂
A. T. Chromium Metal	99 min.	0.20 max.	0.10 max.	0.10	0.03 max.	0.01 max.	0.10 max.	0.015 max.
	% Mo	% C	% S	% P	% Si	% Cu	-----	-----
Ferro Molybdenum	60-70	0.10 max.	0.15 max.	0.05 max.	1.00 max.	0.5 max.		
Moly Oxide	57 min.	-----	0.10 max.	0.05 max.	-----	0.50 max.		

APPLICATION: These metals and alloys are used in the production of low and high alloy steels, tool and high speed steels, and cast irons. Other applications are stainless and heat resisting alloys, welding and hardfacing alloys, air and vacuum melted superalloys, and aluminum alloys.

Calcium Containing Alloys

	% Ca	% Si	% Ba	% Mn	% Al
CaSi	29-33	59-63		-----	1.75 max.
BaCaSi	14-18	55-62	14-18	-----	1.75 max.

APPLICATION: Calcium silicon is available in lump, powder and cored wire form. It is a universal deoxidizing and desulfurizing agent in the production of high grade steels. In combination with aluminum, it is used where very high demands are made on the castability, degree of purity and surface quality of steel.

Cored Wire

APPLICATION: Available in the following alloys: (CaSi, CaSiBa, CaC₂, FeB, FeTi, C, Pb, Sulfur); other filling material available on request. Alloys for desulfurization, Mg treatment, and inoculation of cast iron also available.

Manganese Containing Alloys

	% Mn	% Si	% C	% P
Silico Manganese	65-68	16-18.5	2.0 max.	0.20 max.
M. C. FeMn	80-85	1.00 max.	1.5 max.	0.30 max.
Std. FeMn	70 min.	1.20 max.	6-8	0.30 max.

APPLICATION: Manganese gives strength to steel, counteracts the embrittling effect of sulfur, and increases nitrogen solubility.

Chromium Containing Alloys

	% Cr	% Si	% P	% C
FeCrSi	34-40	39-43	0.030 max.	0.05 max.
HCFeCr	60-70	3.0 max.	0.030 max.	5 - 9
LCFeCr	65-75	1.0 max.	0.030 max.	0.05 max.

APPLICATION: Chrome addition conveys hardenability, corrosion resistance, high strength, and high temperature stability. It also produces a fine crystalline structure.

Welding Products and Powdered Alloys

	MESH	% Si	% C	% P	% S
Ferrosilicon 50% Grade, Unstablized	40 x 325	47.0 min.	0.12 max.	0.04 max.	0.02 max.
Ferrosilicon 50% Grade, Stabilized	40 x 325	47.0 min.	0.12 max.	0.04 max.	0.02 max.

APPLICATION: Stabilized and unstabilized Ferrosilicon is used in fluxes for both welding electrodes and core wire.

Typical Field Sample Testings of Carbon Additives

Carbon Type	Carbon	Ash	Vol.	Moist.	Sulphur	Nitrogen ppm	Hydrogen ppm	Oxygen ppm
Desulco	99.8	.10	.10	NIL	.008	13	5	7
Scrap Electrode Graphite	99.0	.40	.15	.15	.009	33	72	1400
Mexican Natural Graphite	69.4	26.80	3.10	.10	.570	750	2200	141400 (14.14%)
Low Sulphur Calcined Petroleum Coke	99.2	.10	.25	.25	.090	200	600	275
Calcined Petroleum Coke	98.4	.22	.50	TR	.850	18560 (1.85%)	1185	1180
Metallurgical Coke	87.2	10.80	.80	NIL	1.150	9090	2980	70600 (7.06%)

Comparative Chemistry	Desulco	Crushed Electrode Scrap Graphite*
Carbon	99.8%	99.0%
Ash	0.1	0.7
Volatiles	<0.1	0.2
Moisture	nil	0.1
Sulphur	0.015	0.050
Size	- 6M + 20M	- 4M + 20M
*Note: Chemistry of crushed electrode scrap graphite was <u>inconsistent</u> , therefore above is average of several tests.		
Carbon Recovery Results Over 34 Heats		
Amount of carbon added	14,118 lbs.	14,220 lbs.
Carbon recovery (average)	94.5%	84.3%
Solution rate	45.0 lbs./min.	32.9 lbs./min.

Conclusions:

- Desulco generated an average of 10.2% greater carbon recovery than crushed electrode scrap graphite.
- Desulco dissolved 12 lbs./min. faster than crushed electrode scrap graphite.
- Desulco's reduced range of variation in carbon recovery increased precision of achieving aim analysis.
- Desulco's performance was more consistent and dependable due to its quality and purity.