REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	SAG	SAG	MES	MES
0	FINAL	8/15/2016	SAG	SAG	MES	MES

Pure Fonte Ltée

PURE FONTE LTÉE

PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY

CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

FEASIBILITY STUDY

SECTION 11

MTO – MATERIALS TAKE OFF

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

SECTION CONTENTS

NOTICE

This document contains the expression of the professional opinion of TENOVA and TECHINT ENGINEERING AND CONSTRUCTION ("Tenova/TEIC") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the purchase order dated December 22, 2015 (the "**Agreement**") between Tenova/TEIC and PURE FONTE LTÉE (the "**Client**"), and the methodology, procedures and techniques used, Tenova/TEIC's assumptions, and the circumstances and constrains under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

Tenova/TEIC have, in preparing drawings, notes, specifications, calculations and estimates, as the case may be, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual values will be consistent with the estimate(s). However, no warranty should be implied as to the accuracy of estimates. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which Tenova/TEIC's opinion as set out herein is based has not been verified by Tenova/TEIC's; Tenova/TEIC makes no representation as to its accuracy and disclaims all liability with respect thereto.

The concepts, drawings, descriptions, and other information contained in this proposal are considered to be proprietary and are furnished solely for the exclusive use of Tenova/TEIC for the purposes of project evaluation or award of contract, and are not to be disclosed in any form whatsoever to any third party without the expressed written consent of Tenova/TEIC.

The party receiving this document warrants to Tenova/TEIC that they shall take all reasonable precautions to insure against any breach of confidentiality and will advise their employees who might have access to such Confidential Information of the confidential nature thereof. No Confidential Information shall be disclosed to any officer, employee or agent of either party who does not have a need for such information.

All information provided by Tenova/TEIC shall be considered confidential and intellectual property of Tenova/TEIC and likewise all information provided by the Client to Tenova/TEIC shall be treated in the same respect.

To the extent permitted by law, Tenova/TEIC disclaims any liability to the Client and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	-	GMN	RUC	TEI
0	FOR INFORMATION	27/5/16	-	GMN	RUC	TEI

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.1

CIVIL WORKS MTO

3786-TARG-C-MT-000-001

ESC.: N/A | JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.1 Civil Works MTO

The purpose of this document is to provide a Civil Works MTO for the project "Pig Iron Production Plant" of PURE FONTE LTÉE, located at the city of Port Saguenay, Quebec – Canada

11.1.1 Reference documents

Reference documents used to produce this MTO:

1. 3786-TARG-C-DC-000-001 CIVIL WORKS - DESIGN CRITERIA
2. 3786-TARG-X-LY-000-003 GENERAL PLANT - LAY OUT
3. 3786-TARG-C-SP-000-002 INTERNAL ROADS - TECHNICAL SPECIFICATION
4. 3786-TARG-C-SP-000-004 RAINWATER DRAINAGE SYSTEM - TECHNICAL SPECIFICATION
5. 3786-TARG-C-SK-000-002 PAVIMENT AND DRAINAGES - AREA PLANT SKETCH
6. 3786-TARG-P-LY-000-001 SERVICE DISTRIBUTION - GENERAL ROUTING
7. 3786-TARG-P-LY-000-003 SERVICES DISTRIBUTION - FIRE FIGHTING SYSTEM
8. GEOTHECNICAL INVESTIGATION REPORT: FILE No. 634451 - SNC LAVALIN

11.1.2 General Considerations

Site preparation works are out of the scope of the project; see clause 4.1 of Civil Works Design Criteria.

Sanitary Sewer and Potable Water System are not included in the present MTO as they are presented in a separate document from Norda Stelo

The Settling Pond is also presented in the document from Norda Stelo.

11.1.3 Civil works MTO

IT	CRC	CRC description	UNIT	QTY	OBSERVATION
A		**SITE PREPARATION**			**Out of scope**
B		**EXCAVATION**			
1	13120	MASS EXCAVATION - large open areas	m3	0	
2	13200	MASS ROCK EXCAVATION - large open areas	m3	0	
3	13240	TRENCH ROCK EXCAVATION - for underground piping or electrical	m3	0	
4	13140	TRENCH EXCAVATION - for underground piping or electrical	m3	0	
5		EXCAVATION FOR PERIMETRAL DRAINAGE CHANNELS	m3	5600	
C		**BACKFILL**			
1	14124	MASS BACKFILL MG20 (0-20mm) - large open areas	m3	0	
2	14124	MASS BACKFILL MG56 (0-56mm) - large open areas	m3	0	
3	14110	MASS BACKFILL excavated material - large open areas	m3	10550	Backfill below topsoil and gravel
4	14240	TRENCH BACKFILL MG20 (0-20mm) - for underground piping or electrical	m3	0	
5	14240	TRENCH BACKFILL SAND - for underground piping or electrical	m3	0	
6	14230	TRENCH BACKFILL excavated material - for underground piping or electrical	m3	0	
7	14000	TOPSOIL BACKFILL	m3	375	
8		COARSE GRAVEL	m3	4900	Finishing of open areas
D		**GEOTEXTILES & GEOMEMBRANES**			
1	14610	GEOTEXTILE TEXEL 7618	m2	0	
2	14500	GEO MEMBRANE HDPE 1.5mm SMOOTH	m2	0	
3	14550	GEO MEMBRANE HDPE 1.5mm TEXTURED	m2	0	
E		**UNDERGROUND SERVICES**			
E1		**POTABLE WATER**			By others.
E2		**SANITARY SEWER**			By others.
E3		**STORM SEWER**			
1	15645	SS Φ20" REINFORCED CONCRETE PIPE	m	270	
2	15610	SS Φ24" CATCH BASINS	each	0	
3	15620	SS Φ20" MANHOLE	each	18	

IT	CRC	CRC description	UNIT	QTY	OBSERVATION
4		CONCRETE CHANNELS	m	1000	Mean Width and Depth = 0.60m
5		STEEL GRATING FOR CONCRETE CHANNELS	m	96	Mean Width = 0.60m
6		RIP RAP LINING FOR CHANNELS FOR PERIMETRAL (GRAVEL WITH CEMENT)	m3	360	
E4		**FIRE WATER SERVICE**			
1		HDPE PIPE 8"	m	---	In Piping MTO
2		COARSE GRAVEL	m3	21	
3		LEAN CONCRETE	m3	20	
4		CONCRETE FOR BLOCK VALVE BOXES	m3	72	
5		ROCK EXCAVATION	m3	874	
6		NATURAL SOIL EXCAVATION	m3	4955	
7		BACKFILL MG20 (0-20mm)	m3	564	
8		BACKFILL excavated material	m3	5068	
E5		**UNDERGROUND ELECTRICAL SERVICE**			Cable routing is above ground.
1	15920	DUCT BANKS - SULPHATE RESISTANT CONCRETE	m3	0	
F		**ROADS & PARKING LOTS**			
1		Concrete wearing course	m2	4800	
2	16200	GRAVEL PAVED SURFACES - 200mm of MG20 (0-20mm) compacted	m2	15100	
3		225 mm MG20 (0-20mm) base	m2	19900	
4		200 mm MG112 (0-112mm) sub base	m2	6800	
5		450 mm MG300 (0-300mm) sub base	m2	6800	
G		**RAILROAD**			Out of scope.
H		**FINISHING ITEMS**			
1	17300	FENCING WITH BARBED WIRE	m	1250	
2	17330	PEDESTRIAN FENCE GATES	each	1	
3	17335	VEHICULAR FENCE GATES	each	1	
4	16300	SIDEWALKS & CURBS	m3	60	
5	17220	SEEDING	m2	3750	

Table 11.1-1.: Civil works MTO

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	-	GMN	RUC	TEI
0	FOR INFORMATION	27/05/16	-	GMN	RUC	TEI
C	PRELIMINARY	20/05/16	-	GMN	RUC	TEI
B	PRELIMINARY	10/05/16	-	GMN	RUC	TEI
A	PRELIMINARY	18/04/16	-	GMN	RUC	TEI

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.2

CONCRETE MTO

3786-TARG-C-MT-000-003

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.2 Concrete MTO

The purpose of this document is to provide a very preliminary estimation for the alternative Plant accordingly to the new lay out (3786-TARG-X-SK-000-001 REV 0) and to the considerations indicated in item 3, for the project "Pig Iron Production Plant" of PURE FONTE LTÉE, located at the city of Port Saguenay, Quebec - Canada.

11.2.1 Reference documents

Reference documents used to produce this MTO:

1. 3786-TARG-C-DC-000-001 CIVIL WORKS - DESIGN CRITERIA
2. 3786-TARG-X-LY-000-003 GENERAL PLANT - LAY OUT
3. 3786-TARG-X-EL-000-001 MECHANICAL EQUIPMENT LIST – LIST
4. 3786-TARG-E-LY-000-005 GENERAL CABLE ROUTING - LAY OUT
5. GEOTHECNICAL INVESTIGATION REPORT: FILE No. 634451 - SNC LAVALIN
6. 3786-TARG-X-LY-200-003 IRON ORE PELLETS RECEIVING & STORAGE AREA - LAY OUT
7. 3786-TARG-X-SK-200-001 IRON ORE PELLETS RECEIVING & STORAGE AREA – LOADS
8. 3786-TARG-X-LY-300-001 IRON ORE PELLETS - MATERIAL HANDLING - LAYOUT
9. PLAN & SECTION
10. 3786-TARG-X-LY-300-002 IRON ORE PELLETS - MATERIAL HANDLING - LAYOUT - SECTIONS
11. 3786-TARG-X-LY-300-003 IRON ORE PELLETS - MATERIAL HANDLING - LAYOUT - SECTIONS
12. 3786-TARG-X-SK-300-001 IRON ORE PELLETS - MATERIAL HANDLING - LOADS
13. 3786-TARG-X-SK-300-002 IRON ORE PELLETS - DAY BIN - LOADS - SKETCH
14. 3786-TARG-X-SK-300-003 IRON ORE PELLETS - MATERIAL HANDLING - LOADS SECTIONS
15. 3786-TARG-X-SK-330-001 IRON ORE PELLETS - COATING STATION
16. FOUNDATION LOADS - SKETCH
17. 3786-TARG-X-SK-330-002 IRON ORE PELLETS - COATING STATION BUILDING
18. FOUNDATION LOADS – SKETCH
19. 3786-TARG-X-LY-500-001 DRI PLANT – PLAN – LAY OUT
20. 3786-TARG-C-SK-500-001 DRI REACTOR TOWER – FOUNDATIONS
21. 3786-TARG-S-SK-600-001 EAF BUILDING - PLANS & ELEVATIONS

22. 3786-TARG-X-LY-600-004 EAF AREA - PLAN - LAY OUT
23. 3786-TARG-X-LY-600-005 EAF AREA - SECTION A-A
24. 3786-TARG-X-SK-600-003 EAF AREA - FOUNDATION LOADS
25. 3786-TARG-C-SK-625-001 EAF FOUNDATIONS
26. 3786-TARG-C-SK-645-001 EAF BUILDING FOUNDATIONS
27. 3786-TARG-S-SK-700-001 PIG IRON BUILDING - PLANS & ELEVATIONS
28. 3786-TARG-X-LY-700-003 PIG IRON AREA - PLAN - LAY OUT
29. 3786-TARG-X-LY-700-004 PIG IRON AREA - SECTION A-A & B-B - LAY OUT
30. 3786-TARG-X-SK-700-006 PIG CASTING - FOUNDATION LOADS
31. 3786-TARG-V-DS-000-003 FRESH FIRE WATER STORAGE TANK TK-825-01
32. 3786-TARG-X-LY-825-001 WATER TREATMENT PLANT - PLAN - LAY OUT
33. 3786-TARG-X-LY-600-006 HOT PROCESSING AREA – BAG FILTER SYSTEM - LAY OUT
34. 3786-TARG-X-LY-600-007 HOT PROCESSING AREA – BAG FILTER ASSEMBLY - LAY OUT
35. 3786-TARG-X-LY-600-008 HOT PROCESSING AREA – STACK ASSEMBLY - LAY OUT
36. 3786-TARG-E-LY-000-006 ELECTRIC CABIN CE-05 - LAY OUT
37. 3786-TARG-P-LY-000-001 SERVICE DISTRIBUTION - GENERAL ROUTING

11.2.2 General Considerations

The concrete estimation has been realized in two phases: the first one with a larger footprint for the plant and the second one with the so called “optimized” layout, which this MTO refers to.

For foundation excavations, the following relations are considered:
- excavation in rock: 1H:4V
- excavation in soil: 1H:2V
- Lean concrete thickness= 5cm
- Lateral over-excavation= 50 cm
- Quantities include foundation for the piperack inside the DRI Plant and for Electric cabin CE-DR-A.
- Quantities include foundation for EAF, Ladle Transfer Car and Ladle Vertical Preheater Station.
- Quantities include foundation for the Electrical cabin CE-04.

- According to the boreholes, in the Day Bin's area rock was not encountered in the foundation area (see Borehole BH-21). Foundations are foreseen over clay.
- According to the boreholes, in the conveyor's area it is considered the top of rock at +138.00 masl under engineered fill.
- According to the boreholes, it is considered the top of rock at +137.50 masl under engineered fill.
- According to the boreholes, in the area of the Coating Station it is considered the top of rock at +137.50 masl under engineered fill.
- Quantities only for excavations and backfill for Below Grade Tunnel
- Quantities include foundation for CE-01 and SVC Building. Trenches and manholes inside the Electrical Substation are included.

11.2.3 Concrete MTO

IT	CRC	CRC description	Unit	1: IRON ORE PELLETS RECEIVING AREA	2: IRON ORE PELLETS STORAGE AREA	3: MATERIAL HANDLING	4: BRIQUETTING PLANT	5.1: DRI PLANT	5.2.: DRI REACTOR TOWER & HEATER	6.1. EAF BUILDING FOUNDATION	6.2 EAF FOUNDATIONS	6.3: EQUIPMENTS FDN & PAVEMENTS	71. PIG CASTING BUILDING	7.2.: EQUIPMENTS FDN - STOCK PILE & PAVEMENTS	8.1: WATER TREATMENT PLANT	8.4: PIPERACK & SLEEPERS	8.5: ELECTRICAL SUBESTATION	8.7: FUMES TREATMENT PLANT	8.9: DIESEL FUEL GAS STATION	8.10: ELECTRIC CABIN CE-05	8.11: EXTERIOR LIGHTING	TOTAL
1	21100	Spread footings (incl. concrete, formwork & rebar)	m3	147	0	160	0	164	949	875	73	142	568	182	400	224	212	349	0	0	230	***4674***
2	21200	Strip footings (incl. concrete, formwork & rebar)	m3	0	0	146	375	0	0	65	0	59	0	0	199	0	0	123	0	0	0	***966***
3	21400	Piers (incl. concrete, formwork & rebar)	m3	45	0	48	5	65	56	82	139	125	108	52	10	125	64	9	1	29	0	***963***
4	21600	Walls (incl. concrete, formwork & rebar)	m3	0	0	79	0	0	0	0	100	444	0	30	227	0	0	0	0	0	0	***881***
5	21640	Ring walls (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	***6***
6	21700	Raft structures (incl. concrete, formwork & rebar)	m3	0	0	0	0	66	0	0	286	116	0	66	0	0	0	0	0	248	0	***781***
7	21900	Equipment pads (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	0	0	0	0	0	86	0	0	0	0	***86***
8	23100	Slabs on grade reinforced (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	455	0	0	204	0	159	0	22	0	0	***840***
9	23200	Slabs grade (incl. concrete, formwork & welded wire mesh)	m3	89	0	104	88	0	0	0	0	649	0	227	350	0	116	49	3	0	0	***1676***
10	24200	Columns (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	***50***
11	24400	Elevated structural slabs (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	12	260	0	0	89	0	0	0	0	0	0	***361***
12	24440	Elevated slab poured on steel deck (incl. conc, form & rebar)	m3	0	0	0	0	0	0	0	0	0	0	0	132	0	0	0	0	0	0	***132***
13	24800	Elevated Beams (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	15	0	0	112	0	0	0	0	0	0	***127***
14	26000	Precast concrete structures (shop fab & installation)	m3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	***3***

IT	CRC	CRC description	Unit	1: IRON ORE PELLETS RECEIVING AREA	2: IRON ORE PELLETS STORAGE AREA	3: MATERIAL HANDLING	4: BRIQUETTING PLANT	5.1: DRI PLANT	5.2.: DRI REACTOR TOWER & HEATER	6.1. EAF BUILDING FOUNDATION	6.2 EAF FOUNDATIONS	6.3: EQUIPMENTS FDN & PAVEMENTS	71. PIG CASTING BUILDING	7.2.: EQUIPMENTS FDN - STOCK PILE & PAVEMENTS	8.1: WATER TREATMENT PLANT	8.4: PIPERACK & SLEEPERS	8.5: ELECTRICAL SUBESTATION	8.7: FUMES TREATMENT PLANT	8.9: DIESEL FUEL GAS STATION	8.10: ELECTRIC CABIN CE-05	8.11: EXTERIOR LIGHTING	TOTAL
15	26800	Precast sleepers (shop fab & installation)	m3	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	***5***
16	27100	Pits & sumps (incl. concrete, formwork & rebar)	m3	0	0	0	0	0	0	0	0	48	0	0	0	0	56	0	0	0	0	***104***
17	27400	Curbs (incl. conc form & rebar)	m3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
18	29200	Anchor bolts	kg	958	0	1638	1877	1475	5025	0	3046	1871	0	3690	872	1772	1810	1743	0	1383	0	***27160***
19	29500	2" rigid SM blue insulation	m2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
20	29510	Lean concrete (supply and install)	m3	10	0	26	19	25	34	50	18	27	25	22	103	21	49	18	4	25	7	***482***
21	29515	2" HI-40 rigid insulation	m2	0	0	0	0	168	0	0	0	0	0	168	0	56	848	0	67	563	0	***1868***
22	29520	Damproofing on foundation walls 3 coats	m2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
23	29530	Waterproofing membrane on foundation walls HDPE 2 mm	m2	0	0	0	0	0	0	0	0	0	0	0	0	0	555	0	0	0	0	***555***
24	29810	Hardener applied to slabs	m2	444	0	522	440	0	0	0	0	1520	0	1134	1320	0	0	247	0	0	0	***5627***
25	29830	Epoxy coatings on concrete surfaces	m2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
26	13130	DETAILED EXCAVATION - at buidlings or equipment foundations	m3	2184	2100	4436	1658	2419	2047	3846	1126	1298	3526	4951	6081	3115	3694	1679	71	232	133	***44596***
27	13230	DETAILED ROCK EXCAVATION - at buidlings or equipment foundations	m3	369	420	201	0	806	682	1282	375	423	484	752	0	745	0	96	0	77	23	***6736***
28	14220	DETAILED BACKFILL MG20 (0-20mm) - at building or equipment foundations	m3	328	0	319	290	217	127	229	158	1813	74	467	404	196	723	231	43	278	0	***5895***
29	14225	DETAILED BACKFILL SAND - at building or equipment foundations	m3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	***0***
30	14210	DETAILED BACKFILL excavated material - at building or equipment foundations	m3	2246	1300	3964	1204	2783	1582	3740	926	1325	3218	5441	4398	3326	2037	1037	0	7	0	***38534***
31		STEEL ROCK ANCHORS 35M (EMBEDMENT LENGHT IN ROCK = 4.00m)	ea	0	0	0	0	0	16	20	4	24	0	0	0	0	0	0	0	0	0	***64***

IT	CRC	CRC description	Unit	1: IRON ORE PELLETS RECEIVING AREA	2: IRON ORE PELLETS STORAGE AREA	3: MATERIAL HANDLING	4: BRIQUETTING PLANT	5.1: DRI PLANT	5.2.: DRI REACTOR TOWER & HEATER	6.1. EAF BUILDING FOUNDATION	6.2 EAF FOUNDATIONS	6.3: EQUIPMENTS FDN & PAVEMENTS	71. PIG CASTING BUILDING	7.2.: EQUIPMENTS FDN - STOCK PILE & PAVEMENTS	8.1: WATER TREATMENT PLANT	8.4: PIPERACK & SLEEPERS	8.5: ELECTRICAL SUBESTATION	8.7: FUMES TREATMENT PLANT	8.9: DIESEL FUEL GAS STATION	8.10: ELECTRIC CABIN CE-05	8.11: EXTERIOR LIGHTING	TOTAL
32		STEEL ROCK ANCHORS 45M (EMBEDMENT LENGHT IN ROCK = 5.50m)	ea	28	0	32	0	0	24	160	0	32	96	0	0	0	0	0	0	0	0	***372***
33		STEEL ROCK ANCHORS 55M (EMBEDMENT LENGHT IN ROCK = 7.00m)	ea	0	0	0	0	0	128	0	0	0	0	0	0	0	0	0	0	0	0	***128***
34		Foundation Beams (incl. concrete, formwork & rebar)	m3	49	0	35	18	0	0	0	0	0	0	13	0	0	0	12	0	0	0	***127***
35		Frost Walls (incl. concrete, formwork & rebar)	m3	59	0	61	11	0	0	192	0	0	107	0	159	0	99	0	0	0	0	***688***
36		Precast concrete enclosure walls (shop fab & installation) (thk = 20cm)	m2	0	0	0	0	0	0	0	0	0	0	0	1397	0	0	0	0	0	0	***1397***
37		Precast concrete slabs (shop fab & installation) (thk = 16cm)	m2	0	0	0	0	0	0	0	0	0	0	0	1257	0	0	0	0	0	0	***1257***
38		Anchor bolts - Diameter: 1-1/2" - Length = 0.75 m - ASTM A-193 Grade B7 (or equivalent)	ea	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	***24***
39		Anchor bolts - Diameter: 2" - Length = 1.00 m - ASTM A-193 Grade B7 (or equivalent)	Ea	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	***32***
40		Anchor bolts - Diameter: 2-1/2" - Length = 1.25 m - ASTM A-193 Grade B7 (or equivalent)	ea	0	0	0	0	0	0	160	0	0	108	0	0	0	0	0	0	0	0	***268***
41		Steel embedments plates	kg	575	0	1060	1140	688	3015	3065	4055	5178	2028	701	10648	1099	1385	1443	3	86	690	***36858***

Table 11.2-1.: Concrete MTO

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	LDM	LDM	LDM	TEI
0	FOR INFORMATION	22.06.2016	LDM	LDM	LDM	TEI

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.3

ELECTRICAL INSTALLATION MATERIAL MTO

3786-TARG-E-MT-000-006

ESC.: N/A | JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.3 Electrical Installation Material MTO

DESCRIPTION	QUANTITY	UNIT
STEEL LADDER TYPE CABLE TRAY AND FITTINGS		
Width 24" (609 mm)		
Steel Ladder type; Straight Section, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 12" (305 mm) rung spacing; 24" (609mm) Width; 144" (3,6 m) Length; Hot Dip Galvanized. Part Number 248G12-24-144 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	1378
Steel Ladder type; 90° Horizontal Bend, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized. Part Number 4G-24-90HB24 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	36
Steel Ladder type; Horizontal TEE, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4G-24-HT24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	48
Steel Ladder type; Horizontal Cross, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4G-24-HX24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	4
Steel Ladder type; 90° Vertical Outside Bend, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4G-24-90VO24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	38
Steel Ladder type; 90° Vertical Inside Bend, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4G-24-90VI24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	38
STEEL SOLID TROUGH CABLE TRAY AND FITTINGS		
Width 24" (609 mm)		
Steel Solid Trough; Straight Section, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 24" (609mm) Width; 144" (3,6 m) Length; Hot Dip Galvanized. Part Number 248GST-24-144 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	367
Steel Solid Trough; 90° Horizontal Bend, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized. Part Number 4GST-24-90HB24 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	10
Steel Solid Trough; Horizontal TEE, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-24-HT24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	18
Steel Solid Trough; Horizontal Cross, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-24-HX24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	2

DESCRIPTION	QUANTITY	UNIT
Steel Solid Trough; 90° Vertical Outside Bend, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 24" (609 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-24-90VO24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	8
Steel Solid Trough; 90° Vertical Inside Bend, 3" NEMA VE-1; 4" (102 mm) Side Rail Height ; 24" (610 mm) Width; 24" (610 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-24-90VI24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	8
Width 12" (305 mm)		
Steel Solid Trough; Straight Section, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 144" (3,6 m) Length; Hot Dip Galvanized. Part Number 248GST-12-144 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	267
Steel Solid Trough; 90° Horizontal Bend, 3" NEMA VE-1 ; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized. Part Number 4GST-12-90HB24 COOPER B-LINE or similar brand. Vendor must include 1 Pair Splice plates with hardware per each straight section.	Each	12
Steel Solid Trough; Horizontal TEE, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-12-HT24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	5
Steel Solid Trough; Horizontal Cross, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-12-HX24 COOPER B-LINE or similar brand.Vendor must include 2 pair splice plates with hardware.	Each	0
Steel Solid Trough; 90° Vertical Outside Bend, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-12-90VO24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	4
Steel Solid Trough; 90° Vertical Inside Bend, 3" NEMA VE-1; 4" (101 mm) Side Rail Height ; 12" (305 mm) Width; 24" (609 mm) Radius ; Hot Dip Galvanized, Part Number 4GST-12-90VI24 COOPER B-LINE or similar brand. Vendor must include 2 pair splice plates with hardware.	Each	4
STEEL SOLID FLANGED COVERS		
Width 24" (609 mm)		
Stell Cover for Cable Tray 24" Width - 3" NEMA VE-1 ; Solid Flanged System, 72" (1,83 m) Length; Hot Dip Galvanized, Part Number 802G-18-24-72 COOPER B-LINE or similar brand.	Each	2389
Stell Cover for 90° Horizontal Bend - 3" NEMA VE-1 ; 24" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-24-90HB24 COOPER B-LINE or similar brand.	Each	31
Stell Cover for Horizontal Tee - 3" NEMA VE-1 ; 24" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-24-HT24 COOPER B-LINE or similar brand.	Each	39
Stell Cover for Horizontal Cross - 3" NEMA VE-1 ; 24" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-24-HX24 COOPER B-LINE or similar brand.	Each	3
Stell Cover for 90° Vertical Outside Bend - 3" NEMA VE-1 ; 24" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-24-90VO24-4 COOPER B-LINE or similar brand.	Each	34
Stell Cover for 90° Vertical Inside Bend - 3" NEMA VE-1 ; 24" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-24-90VI24 COOPER B-LINE or similar brand.	Each	34

DESCRIPTION	QUANTITY	UNIT
Width 12" (305 mm)		
Stell Cover for Cable Tray 12" Width - 3" NEMA VE-1 ; Solid Flanged System, 72" (1,83 m) Length; Hot Dip Galvanized, Part Number 802G-18-12-72 COOPER B-LINE or similar brand.	Each	535
Stell Cover for 90° Horizontal Bend - 3" NEMA VE-1 ; 12" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-12-90HB24 COOPER B-LINE or similar brand.	Each	12
Stell Cover for Horizontal Tee - 3" NEMA VE-1 ; 12" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-12-HT24 COOPER B-LINE or similar brand.	Each	5
Stell Cover for Horizontal Cross - 3" NEMA VE-1 ; 12" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-12-HX24 COOPER B-LINE or similar brand.	Each	0
Stell Cover for 90° Vertical Outside Bend - 3" NEMA VE-1 ; 12" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-12-90VO24-4 COOPER B-LINE or similar brand.	Each	4
Stell Cover for 90° Vertical Inside Bend - 3" NEMA VE-1 ; 12" Width; 24" Radius; Solid Flanged System, Hot Dip Galvanized, Part Number 802G-18-12-90VI24 COOPER B-LINE or similar brand.	Each	4
STEEL ACCESSORIES FOR CABLE TRAYS		
Cantilever Bracket - for 24" Cable Tray - Hot dip Galvanized Part Number B297-30 HDG COOPER B-LINE or similar brand.	Each	1400
"C" ' Channel 1 5/8"x1 5/8" (41.3 x 41.3 mm) x 6100 mm; Holes Oblong 28.6 x14.3 mm Hot-Dipped Galvanized P1000T-HG UNISTRUT or similar brand	Each	450
Channel Nut w/spring - Ø1/2"-13mm , GALVANIZED - P1010-HG UNISTRUT or similar brand	Each	2800
HOT-DIP GALVANIZED STEEL PIPE, CONDUIT STANDARSD SCH 40, NPT THREAD		
Nominal diameter 11/2"	M	500
Nominal diameter 2"	M	400
Nominal diameter 3"	M	700
Nominal diameter 4"	M	400

Table 11.3-1.: Electrical Installation Material MTO

1	ISSUED	4/4/18	LDM	LDM	LDM	TEI
0	FOR INFORMATION	22.06.16	LDM	LDM	LDM	TEI
REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.4

CABLE MTO

3786-TARG-E-MT-000-005

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.4 Cable MTO

DESCRIPTION	QUANTITY	UNIT
Shielded Single Conductor- 35kV - EPR/Cooper Tape Shield/PVC, Medium Voltage Power, Shielded, UL Type MV-105, 133%/100% Ins Levels, 345 Mil. GENERAL CABLE- Uniblend PVC High Speed (Spec 6555) or similar		
1 x 500 MCM	4100	m
Shielded Single Conductor- 5kV - TR-XLPE/PVC/AIA/PVC , Medium Voltage Power, Shielded, UL Type MV-105, 133%/100% Ins Levels, 90 Mil. TEXCAN - Teck 90 Armoured Power or similar		
1 x 350 MCM	1300	m
1 x 500 MCM	7000	m
Shielded Three Conductor- 5kV - TR-XLPE/PVC/AIA/PVC , Medium Voltage Power, Shielded, UL Type MV-105, 133%/100% Ins Levels, 90 Mil. TEXCAN - Teck 90 Armoured Power or similar		
3 x 2/0 AWG	450	m
3 x 3/0 AWG	400	m
3 x 4/0 AWG	220	m
Four Conductor- 1 kV - XLPE/PVC/AIA/PVC , Low Voltage Power, TEXCAN - Teck 90 Armoured Power or similar		
4 x 14 + Ground 14 AWG	1600	m
4 x 10 + Ground 12 AWG	3300	m
4 x 6 + Ground 8 AWG	500	m
4 x 2 + Ground 8 AWG	700	m
4 x 2/0 + Ground 6 AWG	1600	m

Table 11.4-1.: Cable MTO

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
2	ISSUED	4/4/18	JOO	JOO	LDM	TEI
1	FOR INFORMATION	31.05.2016	JOO	JOO	LDM	TEI
0	FOR INFORMATION	20.05.2016	JOO	JOO	LDM	TEI
A	PRELIMINARY	13.05.2016	JOO	JOO	LDM	TEI

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.5

LIGHTING MTO

3786-TARG-E-MT-000-003

ESC.: N/A | JOB: CD-335

REVISION 2

REVISION

CONTENTS

FIGURES AND REFERENCES

11.5 Lighting MTO

DESCRIPTION	QUANTITY	UNIT
ROAD LED FIXTURE, 241W, VOLTAGE 277V, FREQUENCY 50-60 Hz, PROTECTION IP65 PHILIPS ROADFOCUS LED RFL-241W112LED4K-T-R3M-UNIV	90	each
ROAD LIGHTING POLE. HEIGHT 30' WITH SINGLE ARM LENGTH 8'. MATERIAL HOT-DIP GALVANIZED STEEL.	90	each
FLOODLIGHT LED LIGHTING, 253W, VOLTAGE 277V, FREQUENCY 50-60 Hz, PROTECTION IP65 PHILIPS LIGHTING FX2160YAWNA5NNS, WIDE FLOOD OPTICS- 160 LEDs, 4000K (NW)	120	each
STRAIGHT METALLIC POLE, WHIT OVER POLE PLATFORM AND LADDER WHIT PROTECTION. HEIGHT 50'. MATERIAL HOT-DIP GALVANIZED STEEL.	22	each
WCB JUNCTION BOX. DUST-TIGHT, WEATHERPROOF RAIN & WATERTIGHT, W8", H8", D6".	112	each
INDUSTRIAL LIGHTING FOR INDOOR AREAS. LED LIGHTING, 398W, VOLTAGE 277 V, FREQUENCY 50-60 Hz, PROTECTION IP65 PHILIPS FBX45LL40-UNV-55 GENERAL DISTRIBUTION	180	each
RECEPTACLE FOR WELDING MACHINES, THREE PHASES, 480V, 63 A, 4 POLES (3 PHASES + GROUND) COOPER CROUSE-HINDS - NEMA 4X- IP 66 WATERLIGHT Model CH460MI7W.	20	each
INDUSTRIAL RECEPTACLE FOR GENERAL USES, SINGLE PHASE, 120V, 16 A (PHASE + NEUTRAL + GROUND) COOPER CROUSE-HINDS - NEMA 4X- IP 66 WATERLIGHT Model CH316MI6W	90	each
PHOTOCELL FOR USE WITH LED, OUTDOOR LIGHTINGS, VOLTAGE RANGE 277V, 50/60Hz.	10	each
RIGID STEEL CONDUIT HOT DIP GALVANIZED, DIAM. 1", RSC TYPE (ANSI C80.1)	500	m
LIGHTING BULK MATERIAL (minor materials and accessories, percentage of total requisition of materials)	20	%

Table 11.5-1.: Lighting MTO

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	JOO	JOO	LDM	TEI
0	FOR INFORMATION	20.05.2016	JOO	JOO	LDM	TEI
B	FOR APPROVAL	13.05.2016	JOO	JOO	LDM	TEI
A	PRELIMINARY	13.04.2016	ASO	ASO	VIF	PLO

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.6

GROUNDING MTO

3786-TARG-E-MT-000-002

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.6 Grounding MTO

DESCRIPTION	QUANTITY	UNIT
CABLE - BARE CONDUCTOR 1 x 2 AWG BARE CONDUCTOR (GROUNDING-AWG)	2650	M
CABLE - BARE CONDUCTOR 1 x 4 AWG BARE CONDUCTOR (GROUNDING-AWG)	2520	M
CABLE - BARE CONDUCTOR 1 x 2/0 AWG BARE CONDUCTOR (GROUNDING-AWG)	4000	M
CABLE - BARE CONDUCTOR 1 x 250 MCM BARE CONDUCTOR (GROUNDING-AWG)	5215	M
SPLICE AND TERMINAL COPPER COMPRESSION TERMINAL - ONE HOLE - STANDARD LENGTH BARREL 2 AWG - Diameter Screw 3/8" COPPER TINNED	1206	C/U
SPLICE AND TERMINAL COPPER COMPRESSION TERMINAL - ONE HOLE - STANDARD LENGTH BARREL 4 AWG - Diameter Screw 3/8" COPPER TINNED	304	C/U
SPLICE AND TERMINAL COPPER COMPRESSION TERMINAL - ONE HOLE - STANDARD LENGTH BARREL 2/0 AWG - Diameter Screw 3/8" COPPER TINNED	52	C/U
GROUND BARE 100x5x350 Millimeters	70	C/U
GROUNDING - WELD METAL TUBE C 45	200	C/U
GROUNDING - WELD METAL TUBE C 115	10	C/U
GROUNDING - WELD METAL TUBE C 150	597	C/U
CONCRETE PIPE Longitude 1000 x Diameter 300 Millimeters	5	C/U
FLEXIBLE CONECTOR One Braid Drill 9mm Long 200 millimeters 110 Amps	4	C/U
CLAMP ONE CABLE DIRECTLY ON BAR SURFACE 10-35 Square Millimeters	1568	C/U
CLAMP TWO CABLES DIRECTLY ON BAR SURFACE 50-70 Square Millimeters	213	C/U
CLAMP ONE CABLE SEPARATE FROM BAR SURFACE 50-95 Square Millimeters	12	C/U
CLAMP TWO CABLES SEPARATE FROM BAR SURFACE 25-35 Square Millimeters	196	C/U
CLAMP TWO CABLES SEPARATE FROM BAR SURFACE 50-70 Square Millimeters	6	C/U
FENCE POST GROUNDIG CONNECTOR OR ROD FOR TWO CABLES 3/4" Diameter	5	C/U
GROUNDING - MOLD GT TYPE - 2 CABLE TO GROUND ROD DIAMETER 3/4" 250 MCM WELD 150	14	C/U
STANDARD GROUNG ROD Diameter 3/4 Inch - Length 10 Foot	19	C/U
POINTED AIR TERMINAL 1/2" DIAMETER 36" LENGTH COPPER (CLASS II) - LIGHTNING PROTECTION	213	C/U
GROUNDING - MOLD SS TYPE - CABLE TO CABLE HORIZONTAL SPLICE 250 MCM weld 115	1	C/U
GROUNDING - MOLD TA TYPE - CABLE TO CABLE HORIZONTAL TEE 2/0-2 SOLID AWG Weld 45	7	C/U
GROUNDING - MOLD TA TYPE - CABLE TO CABLE HORIZONTAL TEE 250-4 AWG Weld 90	7	C/U
GROUNDING - MOLD TA TYPE - CABLE TO CABLE HORIZONTAL TEE 250-250 MCM Weld 150	3	C/U

DESCRIPTION	QUANTITY	UNIT
GROUNDING - MOLD TA TYPE - CABLE TO CABLE HORIZONTAL TEE 4/0-4/0 AWG Weld 150	3	C/U
GROUNDING - PARALLEL CLAMP 16-50 Square Millimeters	1176	C/U
GROUNDING - MOLD VG TYPE - HORIZONTAL CABLE ON TO VERTICAL STEEL SURFACE 2/0 AWG weld 115	6	C/U
GROUNDING - VERTICAL/HORIZONTAL MOUNT POINT BASE 1/2" DIAMETER SQUARE OF BRONZE	213	C/U
GROUNDING - MOLD XB TYPE - CROSS OF HORIZONTAL CABLES - LAPPED AND NOT CUT 250-250 MCM Weld 2-150	4	C/U
CONDUIT PVC ELECTRICAL CONDUIT SCHEDULE 40 1 Inch	606	M

Table 11.6-1.: Grounding MTO

1	ISSUED	4/4/18	LDM	LDM	LDM	TEI
0	FOR INFORMATION	20.05.2016	LDM	LDM	LDM	TEI
A	PRELIMINARY	11.05.2016	LDM	LDM	LDM	TEI
REV.	**DESCRIPTION**	**DATE**	**PROJ.**	**EXEC.**	**CHECK.**	**APPR.**

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.7

MV INTERCONNECTION CABLE MTO

3786-TARG-E-CL-000-001

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.7 MV Interconnection Cable MTO

Cable N°	From		To		Cable Type	Voltaje	Cross Section	Line Length	Installation Type	Drawing N°
	Description	CE	Description	CE		(V)	AWG / MCM	(m)		
MV-35-001	SWG-34,5 kV	CE-01	EAF Transformer	CE-10 EAF	TECK 90 Armoured Power 345 MIL 100% 35 kV TR-XLPE/PVC/AIA/ PVC	34500	3(3(1x500)) MCM	200	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-001	SWG-4,16 kV	CE-01	SWG-4,16 kV - STELL MELT SHOP CABIN	CE-02	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	2(3(1x500)) MCM	285	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-002	SWG-4,16 kV	CE-01	SWG-4,16 kV - DRI	CE-05	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	3(3(1x500)) MCM	340	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-003	SWG-4,16 kV	CE-01	SWG-4,16 kV - BAG FILTER	CE-05	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	2(3(1x500)) MCM	340	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-004	SWG-4,16 kV	CE-01	SWG-4,16 kV - WTP & BRIQUETING PLANT	CE-05	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	3(3(1x500)) MCM	340	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-005	SWG-4,16 kV	CE-01	ELECTRICAL CABIN - MAIN OFFICES	CE-06	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	1(3x2/0) AWG	550	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-006	SWG-4,16 kV	CE-05	ELECTRICAL CABIN (DRI - CO2 & REDUCING GAS)	CE-DR-B	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	1(3x3/0) AWG	205	Cable Tray with cover	3786-TARG-E-LY-000-005

Cable N°	From		To		Cable Type	Voltaje	Cross Section	Line Length	Installation Type	Drawing N°
	Description	CE	Description	CE		(V)	AWG / MCM	(m)		
MV-5-007	SWG-4,16 kV	CE-05	WTP-ELECTRICAL CABIN	CE-WTP	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	1(3(1x350)) MCM	180	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-008	SWG-4,16 kV	CE-05	WTP-ELECTRICAL CABIN	CE-WTP	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	1(3(1x350)) MCM	180	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-009	SWG-4,16 kV	CE-05	BRIQUETING PLANT ELECTRICAL CABIN	CE-BP	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	2(3x4/0) AWG	270	Cable Tray with cover	3786-TARG-E-LY-000-005
MV-5-010	SWG-4,16 kV	CE-02	MELTING BAY CRANE	MCC Crane	TECK 90 Armoured Power 90 MIL 100%/133% 5kV TR-XLPE/PVC/AIA/ PVC	4160	1(3x3/0) AWG	260	Cable Tray with cover	3786-TARG-E-LY-000-005

Table 11.7-1.: MV Interconnection Cable MTO

1	ISSUED	4/4/18	JOU	JOU	TEI	TEI
0	FOR INFORMATION	22/06/16	JOU	JOU	TEI	TEI
A	PRELIMINARY	08/06/16	JOU	JOU	TEI	TEI
REV.	**DESCRIPTION**	**DATE**	**PROJ.**	**EXEC.**	**CHECK.**	**APPR.**

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.8

MATERIAL FOR INSTRUMENT ERECTION

3786-TARG-I-MT-000-004

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.8 Mechanical and Electrical Material for Instrument Erection

The purpose of this document is listing the mechanical materials necessary to install instrumentation out of scope of TECHNOLOGICAL PACKAGE EQUIPMENT. For Instruments supplied as part of packages (ie.: DRI, EAF, Handling, etc.) no material for instrument mounting was computed. At this stage it is assumed that material will be supplied by package vendors.

Also, is part of the purpose of this document to list main electrical materials required to install all process plants instrumentation.

This material take-off applies to the greenfield Pure Fonte Ltée Pig Iron Production Plant, located near the city of Port Saguenay, Quebec - Canada.

Neither this is specification nor listed quantities are for PURCHASING, they should only be used in conjunction to get a budgetary quotation.

11.8.1 Reference documents

Reference documents used to produce this MTO:

1. 3786-TARG-I-DC-000-001Automation - Design Criteria
2. 3786-TARG-I-SK-000-001General Instrumentation Cable routing
3. 3786-TARG-I-LI-000-001INSTRUMENT LIST - FS Class 2 - Instrument & Control Equipment List
4. 3786-TARG-I-MT-000-005INSTRUMENT CABLES - MTO
5. 3786-TARG-E-MT-000-001Installation Material - MTO
6. 3786-TARG-I-MR-000-002INSTRUMENTATION MATERIAL REQUISITION (out of scope of package equipment)

11.8.2 General Considerations

Materials for mechanical erection:
Inline instrumentation and valves: all gaskets, stud bolts and nuts by PIPING. This mechanical material is the material required to installed instrumentation required per referenced 3786-TARG-I-MR-000-002.

Materials for electrical erection:
Instrumentation Cable trays main route, for material take off, see 3786-TARG-E-MT-000-001.
Instrumentation Cable trays inside process areas, for material take off, see: FUTURE.
For electrical material calculations, the following criteria was followed
Computation was based in an I/O Count.
Signals were segregated as not to have electrical noise interference.
Cable termination at instruments and junction boxes or local panels in process areas was performed with cable glands. All cable glands designed for Cl 1 Div 2 for mechanical resistance. For intrinsically safe installations, EPC to confirm criteria.

11.8.3 Mechanical Bill of Quantities

ITEM	DESCRIPTION	UNIT	Qty. this revision
001	PIPE NPS 2" CS ASTM A53 - SCH 40	M	100
002	PIPE NPS 1" CS ASTM A106 Gr B GALV - SCH 80 SEAMLESS	M	300
003	PIPE NPS 1/2" CS ASTM A106 Gr B GALV - SCH 80 SEAMLESS	M	300
101	90° ELBOW 1" NPTF GALV #150	each	30
102	UNION 1" NPTF GALV #150	each	40
103	REDUCING TEE 1" NPT X 1/2" NPT GALV #150	each	40
104	PLUG 1/2" NPT GALV #150	each	25
105	REDUCING BUSHING 1" NPTM x 1/2" NPTF GALV #150	each	45
106	PLUG HEX. HEAD 1/2" NPTF #3000 AISI 316	each	60
107	REDUCING ADAPTOR 1/4" NPTH x 1/8" NPTM	each	12
108	NORMAL TEE 1/2" NPTF AISI 316 #3000	each	85
109	NIPLE AISI 316 SCH 80 100mm; 1/2" NPTM x 1/2" NPTM	each	86
110	SWAGE NIPPLE 3/4" NPTM x 1/2" NPTM AISI 316 # 3000	each	25
201	BALL VALVE NPS 1/2" NPTF 600WOG REDUCED BORE BODY AND TRIM AISI 316	each	50
202	BALL VALVE NPS 1/2" NPTF CLASS 800 REDUCED BORE BODY AND TRIM AISI 316	each	25
203	GATE VALVE NPS 1/2" NPTF CLASS 800 BODY & TRIM AISI 316	each	25
204	BLOCK & BLEED VALVE; 1/2" NPTF x 1/2" NPTF # 3000; AISI 316	each	50
301	SEAMLESS TUBE 1/2" OD x 0,049" THK AISI 316L	M	1000
302	MALE CONNECTOR 1/2" OD x 1/2" NPTM DOUBLE FERRULE AISI 316	each	200
303	MALE CONNECTOR 1/2" OD x 1/4" NPTM DOUBLE FERRULE AISI 316	each	140
304	MALE CONNECTOR 1/2" OD x 3/4" NPTM DOUBLE FERRULE AISI 316	each	60
401	STEEL PLATE A-36 # 3/8"	M2	6

Table 11.8-1.: Mechanical bill of quantities for instrumentation

Notes:

1.- For a 5% of materials listed it should be considered an extra price for O2 service cleaning.

2.- Steel and fitting for tubing supports by detail engineering.

3.- Consumables and minor materials, not listed.

11.8.4 Electrical Bill of Quantities

ITEM	DESCRIPTION	UNIT	Qty. this revision	NOTES
01	Rigid Steel Conduit hot dipped galvanized, thick wall, RSC type (ANSI C80.1) - CSA C22.2 N° 45 Safety Standards for Rigid Metal Conduit			1
01.1	Ø ½ ” NPT	m		
01.2	Ø ¾” NPT	m		
01.3	Ø 1” NPT	m	220	
01.5	Ø 2” NPT	m	100	
02	CABLE GLANDS - STRAIGHT BODY MALE – ARMORED CABLE – Aluminum Nickel Plated - EXPLOSIONPROOF CLASS I DIV 2 GROUP C,D; WET LOCATIONS. CEC / CSA Certified, Design for aggressive environment and low ambient temperature			2
02.1	Thread 1/2" NPT ; Cable Diameter xx to xx millimeters	each	8600	1p/1t cable
02.2	Thread 3/4" NPT ; Cable Diameter xx to xx millimeters	each	45	4p / 2c cables
02.3	Thread 1" NPT ; Cable Diameter xx to xx millimeters	each	240	12p/8t cables
02.4	Thread 1" NPT ; Cable Diameter xx to xx millimeters	each	160	24p cables
02.5	Thread 1/2" NPT ; Cable Diameter xx to xx millimeters	each	1100	1p/1t Intrinsically Safe
02.6	Thread 1" NPT ; Cable Diameter xx to xx millimeters	each	30	12p/8t Intrinsically Safe
02.7	Thread 1" NPT ; Cable Diameter xx to xx millimeters	each	25	24p Intrinsically Safe
03	JUNCTION BOXES. Heavy duty for surface mounting. Material: Stainless steel. Area Classification: CSA Type 4X			3

ITEM	DESCRIPTION	UNIT	Qty. this revision	NOTES
03.1	Type 1. Interior dimensions : 500 mm (height), 600 mm (wide), 250 mm (depth). Furnished with two terminal blocks (40 terminals each) for 2.5 mm² cables, mounting on DIN rail, on steel back plate. Furnished with two lateral plastic wireways of 30mm (height) x 40mm (wide) and one central plastic wireway of 40mm (height) x 60mm (wide). Furnished with weather resistant laminated white plastic 1/16" thick, engraved to show black letters on white background. Edges to be beveled. Characters shall be 3/8" high with 3/32" minimum spacing between words. Attach nameplate to panel with stainless steel screws.	each	135	
03.2	Type 2. Interior dimensions : 500 mm (height), 400 mm (wide), 250 mm (depth). Furnished with one terminal block (40 terminals) for 2.5 mm² cables, mounting on DIN rail, on steel back plate. Furnished with two lateral plastic wireways of 30mm (height) x 40mm (wide). Furnished with weather resistant laminated white plastic 1/16" thick, engraved to show black letters on white background. Edges to be beveled. Characters shall be 3/8" high with 3/32" minimum spacing between words. Attach nameplate to panel with stainless steel screws.	each	150	
03.3	Similar to Type 2 (item 03.2) Intrinsically safe circuits	each	10	
03.4	Similar to Type 1 (item 03.1) with T/C terminals	each	8	
03.5	Similar to Type 2 (item 03.2) with T/C terminals	each	6	
03.6	SS Junction box prepared for cable glands access with Fieldbus Foundation (FF) 8-ports and trunk in / out. Zone 2 (Class 1 Div 2) areas	each	45	
11	CABLE TRAYS. Hot dip galvanized steel cable trays, ladder type. Straight section, lenght: 144"			6
11.1	Width: 6", rung spacing: 6", siderail height: 4"	m	3000	
11.2	Width: 12", rung spacing: 6", siderail height: 4"	m		
11.3	Width: 24", rung spacing: 9", siderail height: 4"	m		
12	CABLE CHANNEL – Hot dipped Galvanized. Ventilated bottom. Width 50mm. Depth ¾” (20mm). CSA C22.22.	m	60000	

ITEM	DESCRIPTION	UNIT	Qty. this revision	NOTES
21	Jack RJ45. Cat 5 / 6A Ethernet. Capable to withstand POE at 120V 60 Hz. Industrial use. Contact Phosphor Bronze. Gold Plating over nickel. Shielded cables / plugs	each	150	
22	Plug RJ45 CAT5/CAT6 Ethernet. RJ45 Plug. Capable to withstand POE at 120V 60 Hz. Industrial use. Shielded cables.	each	150	
23	PROFIBUS DP MALE CONNECTOR, 9-pin D-sub, metallic housing, terminal resistor with slide switch, screw connection terminal block.	each	200	
81	**STEEL ANGLES A-36**			
81.1	3/4" x 1/8" thickness	m	2000	
81.2	1" x 1/8" thickness	m	1000	
81.3	1½" x 3/16"	m		
81.4	2" x 1/4"	m	200	
82	**STEEL PLATES A-36**			
82.1	3/16" thickness	m2	12	
82.2	1/4" thickness	m2		
82.3	3/8" thickness	m2		
91	Trench for underground armored cables, depth 2000mm	m	1800	
92	Concrete manholes 800 x 800 x 2000	each	20	
99	Cables termination, including supply of terminal, conductor and cable identification, fastening, etc. for sizes 14 AWG to 22 AWG	each	70500	

Table 11.8-2.: Electrical bill of quantities for instrumentation

NOTES

1.- Conduit to be used only as guided support.

2.- Cable gland dimensions to be confirmed after cable awarding.

3.- Dimensions and details of Junction Boxes to be confirmed by EPC contractor.
4.- Minor material such as: cable terminals, cable markers, shrinkable tubes, etc and steel plate and C or T channels, bolts, nuts, u-bolts, cable ties, clamps, etc. shall be by erection contractor.
5.- Other materials as bushings, fittings, supports by detail engineering.
6.- For Cable trays and cable tray accessories for Instrumentation, Control and Telecom, see 3786-TARG-E-MT- 000-001. Main cable routings in Packaged Process Units not included. By Others. Cable tray quantities, only to access junction boxes or local panels.
7.- For Instrumentation Cables Material Takeoff, see 3786-TARG-I-MT-000-005
8.- Quantities to be adjusted during detail engineering.
9.- Fire & Gas System, materials for installation were not included, cost estimation was required to bidders, see 3786-TARG-M-MR-000-003.
9.- Structured Cabling and Access Control, an estimation of quantities was included.
10.- Paging: material quantities will depend on the vendor models finally selected, what was included in this document is only for budgetary purposes.
11.- Materials for Truck Control system, not included. FUTURE.
12.- Materials for Primary Scrap Area, not included. FUTURE.
13.- Materials for Slag Processing Plant, not included. FUTURE.
14.- Materials for Laboratory in EAF Control Room Building, not included. FUTURE.

1	ISSUED	4/4/18	JOU	JOU	TEI	TEI
0	FOR INFORMATION	22/06/16	JOU	JOU	TEI	TEI
A	PRELIMINARY	08/06/16	JOU	JOU	TEI	TEI
REV.	**DESCRIPTION**	**DATE**	**PROJ.**	**EXEC.**	**CHECK.**	**APPR.**

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.9

CONTROL AND INSTRUMENTATION CABLES

3786-TARG-I-MT-000-005

ESC.: N/A | JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.9 Control & Instrumentation cables

The purpose of this document is to cover the minimum requirements and specification of Control & Instrumentation cables to be used in the greenfield North Atlantic Iron Corporation (NAIC) Pig Iron Production Plant.

Neither this specification nor listed quantities are for PURCHASING, they should only be used in conjunction to get a budgetary quotation.

11.9.1 Reference documents

Cables shall be designed, manufactured, stamped and certified in accordance with the latest editions of the regulations, codes, standards and specifications referenced. In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to COMPANY for resolution.

Reference documents used to produce this MTO:

1. 3786-TARG-I-DC-000-001Automation - Design Criteria
2. 3786-TARG-I-SK-000-001General Instrumentation Cable routing
3. 3786-TARG-I-LI-000-001INSTRUMENT LIST - FS Class 2 - Instrument & Control Equipment List

11.9.2 General Considerations

Cables with different specification or different sections, quantity of conductors, etc. may be required during project development.
All special cables to be supplied by the Technological Package Vendors.
Cable estimation based on number of I/O Count informed by Package Vendors, no instrument list available from main packages vendors.
See Particular Notes in Bill of Quantities Table.

11.9.3 Cables description

11.9.3.1 Armored single pair (and triad) cable for analog and digital signals

Armored cable. Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 300 V. Max. Temperature rating: -40 TO 90°C (105°C Dry).
Tray Instrumentation cables to be installed in raceways, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 2

Single-pairs assembled with twisted pairs and overall shielded.

Conductor size:

- Single pairs (and triads): 16 AWG (1.35 mm²)

Specification:

- Armored control and instrumentation cable ACIC per CSA C22.2 No. 239.
- Nominal voltage: 300 Volt - PLTC.
- Service temperature: 105ºC maximum.
- Standards: CSA C22.2 No. 239 ; 174 ; 38 (NEC Code, sec. 725 PLTC, sec. 727 ITC, sec. 800 communications.)
- Construction: UL 13 PLTC Type.
- Fire: CSA FT4 / UL 1685 fire retardant.
- Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:

- Conductor: Annealed copper, 7-wire, class B.
- Insulation: PVC.
- Lay: 50 mm (20 twists/m).
- Shielding: Aluminum-polyester tape and tinned copper drainage wire, 7-wire, class B.
- Jacket: Black PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
- Ripping: Polyamide ripcord under the sheath.
- Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)

Color code:

- Pair: Black / White.

- Triad: White / Red / Black.
- Inner Jacket: Black.
- Outer Jacket: Black

Identification:

- Jacket: ”1 PAIR CABLE (or “1 TRIAD”), Type of cable (TC, MC, SWA, etc) Conductors size, Insulation type, Approval mark of listing authority (CSA, UL, IEC, BS, DIN or equivalent).
- Identifications shall be repeated every meter (manufacturer standard)

Bill of Material Cable Code:

- 1 PAIR CABLE ➔ AE01PA
- 1 TRIAD CABLE ➔ RE01TA

11.9.3.2 Non-Armored single pair (and triad) cable for analog and digital signals

As before., except not armored.

Bill of Material Cable Code:

- 1 PAIR CABLE ➔ AE01PN
- 1 TRIAD CABLE ➔ RE01TN

11.9.3.3 Armored single pair cable for thermocouple extension

Armored cable. Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 300 V. Max. Temperature rating: -40 to 90°C (105 °C Dry).
Tray Instrumentation cables to be installed in raceways, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 2

Single-pairs assembled with twisted pairs and overall shielded.

Construction:

- Solid wires conductors.

Conductor size:

- Single-pair: 16 AWG (1.35 mm²)

Specification:

- Armored control and instrumentation cable ACIC per CSA C22.2 No. 239.
- Nominal voltage: 300 Volt - PLTC.
- Service temperature: 105ºC maximum.
- Standards: CSA C22.2 No. 239 ; 230 ; 38 (NEC Code, sec. 725 PLTC, sec. 727 ITC, sec. 800 communications.)
- Construction: UL 13 PLTC Type.
- Fire: CSA FT4 / UL 1685 fire retardant.
- Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:

- Conductor: Solid wire.
- Insulation: PVC.
- Lay: 50 mm (20 twists/m).
- Shielding: Aluminum-polyester tape and tinned copper drainage wire, 7-wire, class B.
- Jacket: PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
- Ripping: Polyamide ripcord under the sheath.
- Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)

Color code:

Thermocouple “K” type (“KX” cable)

- Positive: Yellow
- Negative: Red
- Jacket: Yellow

Thermocouple “J” type (“JX” cable)

- Positive: White
- Negative: Red
- Jacket: Black

Identification:

- Jacket: Type of cable (TC, MC, SWA, etc) Conductors size, Insulation type, Approval mark of listing authority (CSA, UL, IEC, BS, DIN or equivalent).
- Identifications shall be repeated every meter (manufacturer standard)

Bill of Material Cable Code:

- 1 PAIR CABLE JX ➔ TE01PAJ
- 1 PAIR CABLE KX ➔ TE01PAK

11.9.3.4 Non-Armored single pair cable for thermocouple extension

As before, except not armored.

Bill of Material Cable Code:

- 1 PAIR CABLE JX ➔ TE01PNJ
- 1 PAIR CABLE KX ➔ TE01PNK

11.9.3.5 Armored multi pair (and multi triad) cable for analog signals

Armored cable. Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 300 V. Max. Temperature rating: -40 TO 90°C (105°C Dry).
Tray Instrumentation cables to be installed in raceways, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 2

Single-pairs assembled with twisted pairs and overall shielded.

Conductor size:
•Multi pairs (Multi triads): 16 AWG (1.35 mm²)

Specification:
•Armored control and instrumentation cable ACIC per CSA C22.2 No. 239.
•Nominal voltage: 300 Volt - PLTC.
•Service temperature: 105ºC maximum.
•Standards: CSA C22.2 No. 239 ; 174 ; 38 (NEC Code, sec. 725 PLTC, sec. 727 ITC, sec. 800 communications.)
•Construction: UL 13 PLTC Type.
•Fire: CSA FT4 / UL 1685 fire retardant.
•Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:
•Conductor: Annealed copper, 7-wire, class B.

•Insulation: PVC.
•Lay: 50 mm (20 twists/m).
•Shielding: Overall and individual aluminum-polyester tape, plus tinned copper drainage conductor, 7-wire, class B.
•Communication: 22 awg copper conductor, PVC insulation (for more than 2 pairs or triads).
•Jacket: Black PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
•Ripping: Polyamide ripcord under the sheath.
•Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)
•Number of pairs: 2; 4; 6; 12; 24 / Numer of Triads: 2; 4; 8; 12

Color code:
•Pair: Black / White.
•Triad: White / Red / Black.
•Inner Jacket: Black.
•Outer Jacket: Black

Identification:
•Pairs (Triads): Pair or Triad number
•Jacket: Number of pairs (or triads), Conductor's size, Insulation type, Type of cable (TC, MC, SWA, etc), Approval mark of listing authority (UL, IEC, BS, DIN or equivalent).
• Identifications shall be repeated every meter (manufacturer standard)

Bill of Material Cable Code:
•2 PAIR CABLE AE02PA
•4 PAIR CABLE AE04PA
•6 PAIR CABLE AE06PA
•12 PAIR CABLE AE12PA
•24 PAIR CABLE AE24PA

•2 TRIAD CABLE RE02TA
•4 TRIAD CABLE RE04TA
•12 TRIAD CABLE RE12TA

11.9.3.6 Non-Armored multi pair (and multi triad) cable for analog signals

As before., except not armored.

Bill of Material Cable Code:

- 2 PAIR CABLE ➔ AE02PN
- 4 PAIR CABLE ➔ AE04PN
- 6 PAIR CABLE ➔ AE06PN
- 12 PAIR CABLE ➔ AE12PN
- 24 PAIR CABLE ➔ AE24PN

- 2 TRIAD CABLE ➔ RE02TN
- 4 TRIAD CABLE ➔ RE04TN
- 12 TRIAD CABLE ➔ RE12TN

11.9.3.7 Armored multi pair cable for digital signals

Armored cable. Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 300 V. Max. Temperature rating: -40 TO 90°C (105°C Dry).
Tray Instrumentation cables to be installed in raceways, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 2

Single-pairs assembled with twisted pairs and overall shielded.

Conductor size:

- Multi pairs (Multi triads): 16 AWG (1.35 mm²)

Specification:

- Armored control and instrumentation cable ACIC per CSA C22.2 No. 239.
- Nominal voltage: 300 Volt - PLTC.
- Service temperature: 105ºC maximum.
- Standards: CSA C22.2 No. 239 ; 174 ; 38 (NEC Code, sec. 725 PLTC, sec. 727 ITC, sec. 800 communications.)
- Construction: UL 13 PLTC Type.
- Fire: CSA FT4 / UL 1685 fire retardant.
- Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:

- Conductor: Annealed copper, 7-wire, class B.
- Insulation: PVC.
- Lay: 50 mm (20 twists/m).

- Shielding: Overall aluminum-polyester tape, plus tinned copper drainage conductor, 7-wire, class B.
- Communication: 22 awg copper conductor, PVC insulation (for more than 2 pairs or triads).
- Jacket: Black PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
- Ripping: Polyamide ripcord under the sheath.
- Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)
- Number of pairs: 2; 4; 6; 12; 24 / Numer of Triads: 2; 4; 12

Color code:

- Pair: Black / White.
- Triad: White / Red / Black.
- Inner Jacket: Black.
- Outer Jacket: Black

Identification:

- Pairs (Triads): Pair or Triad number
- Jacket: Number of pairs (or triads), Conductor's size, Insulation type, Type of cable (TC, MC, SWA, etc), Approval mark of listing authority (UL, IEC, BS, DIN or equivalent).
- Identifications shall be repeated every meter (manufacturer standard)

Bill of Material Cable Code:

- 2 PAIR CABLE ➔ DE02PA
- 4 PAIR CABLE ➔ DE04PA
- 6 PAIR CABLE ➔ DE06PA
- 12 PAIR CABLE ➔ DE12PA
- 24 PAIR CABLE ➔ DE24PA

11.9.3.8 Non-Armored multi pair cable for digital signals

As before, except:

Bill of Material Cable Code:

- 2 PAIR CABLE ➔ DE02PN

- 4 PAIR CABLE ➔ DE04PN
- 6 PAIR CABLE ➔ DE06PN
- 12 PAIR CABLE ➔ DE12PN
- 24 PAIR CABLE ➔ DE24PN

11.9.3.9 Armored control multi-conductor cable

Armored cable. Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 600 V. Temperature rating: -40 TO 90°C.
Cable can be directly buried, installed in raceways, including cable tray in wet or dry environments, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 1 or 2

Conductor size:

- 12 AWG
- 14 AWG

Specification:

- Armored control - multiconductor TECK 90 per CSA C22.2 No. 131.
- Nominal voltage: 600 Volt
- Service temperature: -40 to 90ºC
- Standards: CSA C22.2 No. 174 ; 38
- Fire: CSA FT4 / UL 1685 fire retardant.
- Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:

- Conductor: Annealed copper, 7-wire, class B.
- Grounding conductor: by Manufacturer.
- Insulation: XLPE.
- Lay: By Manufacturer
- Shielding: N/A.
- Jacket: Black PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
- Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)
- Number of active conductors:
    - 14 AWG: 2; 3; 5; 7; 12;

- 12 AWG: 2; 3; 5

Color code:

- 2C – Black & white
- 3C – Black, red & white
- 4C – Black, red, blue & white
- 5C or more than 5C – Black # code2C:

Bill of Material Cable Code:

- 2 C 14 AWG + G ARM
- 3 C 14 AWG + G ARM
- 5 C 14 AWG + G ARM
- 7 C 14 AWG + G ARM
- 12 C 14 AWG + G ARM

- 2 C 12 AWG + G ARM
- 3 C 12 AWG + G ARM
- 5 C 12 AWG + G ARM

11.9.3.10 Non-armored control multi-conductor cable

Non Armored cable Flame non-propagating, UV sunlight resistant, moisture and hydrocarbons resistant. Voltage rating: 600 V. Temperature rating: -40 TO 90°C.
Cable can be directly buried, installed in raceways, including cable tray in wet or dry environments, direct burial applications and in outdoor exposed industrial applications. Rated for use in hazardous locations Class 1 Div. 1 or 2

Conductor size:

- 12 AWG
- 14 AWG

Specification:

- Control - multiconductor per CSA C22.2 No. 230 tray cable.
- Nominal voltage: 600 Volt
- Service temperature: -40 to 90ºC
- Standards: CSA C22.2 No. 239 ; 38

- Fire: CSA FT4 / UL 1685 fire retardant.
- Hydrocarbons: Degradation resistant, ASTM D 1239, NF C 32-200.

Description:

- Conductor: Annealed copper, 7-wire, class B.
- Grounding conductor: by Manufacturer.
- Insulation: XLPE.
- Lay: By Manufacturer
- Shielding: N/A.
- Jacket: Black PVC, fire retardant, resistant to mineral oil, sunlight and hydrocarbons.
- Number of active conductors:
    - 14 AWG: 2; 3; 5; 7; 12;
    - 12 AWG: 2; 3; 5

Color code:

- 2C – Black & white
- 3C – Black, red & white
- 4C – Black, red, blue & white
- 5C or more than 5C – Black # code2C:

Bill of Material Cable Code:

- 2 C 14 AWG + G
- 3 C 14 AWG + G
- 5 C 14 AWG + G
- 7 C 14 AWG + G
- 12 C 14 AWG + G

- 2 C 12 AWG + G
- 3 C 12 AWG + G
- 5 C 12 AWG + G

11.9.3.11 Non-armored communication cable

CAT6A (TIA 568 C.2), 4-Bonded-Pair, F/UTP-Foil Shielded, Plenum-CMP, Premise Horizontal Cable, 23 AWG Solid Bare Copper Conductors, FEP Insulation, Inner Jacket, Overall Foil Screen with Drain Wire, Ripcord, Flame retardant Jacket. RJ45 Compliant

Conductor size:

- 23 AWG Solid bare annealed copper

Electrical Characteristics:

- Max. Operating Voltage 300 V RMS.
- Nominal DC Resistance @ 20°C: 7,0 Ohms / 100m
- Nominal velocity of propagation: 70% speed of light
- Nominal capacitance 14 pF / ft.
- Max. Delay 45 ns / 100m.

Insulation and Jacket:

- Insulation Material: FEP PE (Polyethylene) / fluoropolymer
- Outer jacket material: low-smoke Flame retardant PVC - Polyvinyl Chloride, Oil and sun light resistant.
- NEC/CEC Plenum use (NFPA 262)
- Temperature rating: 90°C

Overall shield:

- Type shield and % coverage: polyester / Aluminum foil
- Drain wire 24 AWG solid tinned cooper

Color code:

- Conductors:
    - Pair 1: White/Blue Stripe & Blue
    - Pair 2: White/Orange Stripe & Orange
    - Pair 3: White/Green Stripe & Green
    - Pair 4: White/Brown Stripe & Brown
- Jacket: Black or Grey

Identification:

- Conductors: Conductor number
- Jacket: Number of pairs (triads), conductor's size, insulation type, type of cable (TC, MC, etc), Approval mark of listing authority (UL, IEC, BS, DIN or equivalent).
- Identifications shall be repeated every meter (aprox.)

Bill of Material Cable Code:

- CAT 6A F/UTP

11.9.3.12 Armored communication cable

CAT6A (TIA 568 C.2), 4-Bonded-Pair, F/UTP-Foil Shielded, Plenum-CMP, Premise Horizontal Cable, 23 AWG Solid Bare Copper Conductors, FEP Insulation, Inner Jacket, Overall Foil Screen with Drain Wire, Ripcord, Flame retardant Jacket. RJ45 Compliant

Cable similar to 5.11

- Armour: Aluminum interlocked Armour. (or Galvanized steel wire armour - TBD by EPC)
- Outer jacket material: low-smoke Flame retardant PVC - Polyvinyl Chloride, Oil and sun light resistant. Direct buried.

Bill of Material Cable Code:

- CAT 6A F/UTP ARM

11.9.3.13 Fiber optic cable

Single-mode type, water blocked, with flame non-propagating, sunlight, water and hydrocarbons resistance loose tube jacked, with armor for direct burial in an iron plant environment. It shall be able to be installed in cable trays or buried.

Construction:

- 6, 12, 18 or 24 fibers (as indicated)

Fiber core diameter:

- 9 µm.

Applicable standards:

- ITU G. 652

Cladding Diameter:

- 125 +/- 2 µm.

Performance:

- 1310 / 1550 nm.

Fiber Attenuation:

- Max. 0,40 / 0,33 dB/km

Insulation:

- Medium/High density Polyethylene.

Armor:

- HOLD.

Color code:

- Jacket: Black PE or PVC

Identification:

- Jacket: manufacturer standard. Fibers: different colors, type of cable (TC, MC, etc), Approval mark of listing authority (UL, IEC, BS, DIN or equivalent).
- Identifications shall be repeated every meter (aprox.)

Bill of Material Cable Code:

- 06 FIBERS ➔ FOC x 6
- 12 FIBERS ➔ FOC x 12
- 18 FIBERS ➔ FOC x 18
- 24 FIBERS ➔ FOC x 24

11.9.4 Bill of quantities for control and instrumentation cables

DESCRIPTION	UNIT	Qty. this revision	NOTES
Fiber Optic Cables			
FOC x 6	m	3700	
FOC x 12			
FOC x 18			
FOC x 24	m	2000	2
2 C 14 AWG + G	m	2100	
2 C 14 AWG + G ARM	m	5000	
CAT 6A F/UTP	m	6000	
CAT 6A F/UTP ARM	m	200	
CAT 6A F/UTP ARM	m	3100	3
AE01PA	m	125000	
AE01PA FF	m	11000	4
AE01PA IS	m	17000	5
AE04PA	m	1300	6
AE12PA	m	17500	6
AE12PA IS	m	3600	5; 6
AE24PA	m	11200	6
AE24PA IS	m	3400	5; 6
TE01PAK	m	4200	
TE12PAK	m	1000	7
TE24PAK	m	1200	7
Cable PROFIBUS DP (two pairs 22 AWG)	m	3700	
Armored PROFIBUS DP cable	m	600	
RE01TA	m	1400	
RE08TA	m	200	

Table 11.9-1.: bill of quantities for control and instrumentation cables

NOTES:

1.- At this Project stage it was assumed that all cables will be armored, except when noted.

2.- FO BACKBONE.

3.- EPC to verify cable specification for Ethernet interconnection among field control panels.

4.- To minimize types of cables, it was assumed that 1 pair cable for Fieldbus Foundation (FF) instrumentation is the same as for analog 4 – 20 mA signals.

5.- Intrinsically Safe cables, same specification, except outer jacket in color blue.

6.- All multipairs for discrete signals, were considered as multipairs for analog signals to minimized different types of cables for this budgetary material take-off.

7.- Multipair thermocouple extension cables to be defined by EPC; final information of Technological Packages must be verified.

8.- Fire & Gas System, no cable was included, cost estimation was required to bidders, see 3786-TARG-M-MR-000-003.

9.- Structured Cabling and Access Control, an estimation of cable quantities was included.

10.- Paging: cables types and quantities will depend on the vendor model finally selected, what was included in this document is only for budgetary purposes.

11.- Cables for Truck Control system, not included. FUTURE.

12.- Cables for Primary Scrap Area, not included. FUTURE.

13.- Cables for Slag Processing Plant, not included. FUTURE.

14.- Cables for Laboratory in EAF Control Room Building, not included. FUTURE.

15.- Cables for EAF System do not include the lances and water cooling system.

1	ISSUED	4/4/18	PLI	PLI	GMB	TEI
0	FOR INFORMATION	11/07/16	PLI	PLI	GMB	TEI
A	PRELIMINARY	23/06/16	PRP	PRP	GMB	TEI
REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.10

PIPING MTO

3786-TARG-P-MT-000-002

ESC.: N/A | JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.10 Piping MTO

11.10.1 Reference documents

Reference documents used to produce this MTO:

1. 3786-TARG-R-BF-000-001AUXILIARY SERVICES - BLOCK FLOW DIAGRAM
2. 3786-TARG-R-BF-000-002WATER SYSTEM - BLOCK FLOW DIAGRAM
3. 3786-TARG-R-BF-840-001FIRE FIGHTING NETWORK
4. 3786-TARG-P-FD-000-001SERVICE DISTRIBUTION WATER SYSTEM - FLOW DIAGRAM
5. 3786-TARG-P-FD-000-002SERVICE DISTRIBUTION GASES SYSTEM - FLOW DIAGRAM
6. 3786-TARG-P-LL-000-001PRELIMINARY LINE LIST (MAIN LINES)
7. 3786-TARG-X-SK-000-001NEW GENERAL LAYOUT – PLANT – ALTERNATIVE II-OPTIMIZED

11.10.2 General Considerations

1- Materials related to fluids computed in this form are based on Material Classes Design Rating Criteria Matrix of 3786-TARG-P-DC-000-001
2- Collectors fluids are contemplated until the arrival of individual plants.
3- The material takeoff takes into account only the main fluid lines

11.10.3 Piping MTO by class

	Class	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
HYL	1A1	93		2		4	2					1			
	1P2	124				3	2					2	1		
	1P4	418				23	7	2	2	7	9	8	1		
	1P5	886		2		81	11	19	3	22		94	3		
	1S1	75				15						4			
	3P1	627				70	15	10		15		94	9		
	A01	576		6		14	4	2				6	2		
	M01	285		2		51	10	4	5	7		69			
	M02	91			4	18	1		6	1	3				
	SO4	121				16	1		1	2	9	1			
Total		3296		12	4	295	53	37	17	54	21	279	16		
INTERCONNECTING	C1A	2579	2415	34		136	17					76			
	C1B	947		16		78	22					72			
	C3A	310	310	11		21	3					22			
	C3H	915		19		72	10					62			
	H1F	1986		15		20	21					53			
	S1A	50	50	2		3	2					4			
	S3G	75		2		12	1					8			
Total		6862	2775	99		342	76					297			
WTP	C1A	1858.5	1826.5			327	70	2	41	40		612		85	18
	C3A	55.5	55.5			6	2		3	3		32		6	
	HOLD	190				46									
Total		2104	1882			379	72	2	44	43		644		91	18
Grand Total		**12262**	**4657**	**111**	**4**	**1016**	**201**	**39**	**61**	**97**	**21**	**1220**	**16**	**91**	**18**

Table 11.10-1.: Summary of piping by class

11.10.4 Piping MTO by size

	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admission
HYL	2	146		2		4									
	3	99				1					1	4	1		
	4	454		4		14	4	4		2		21	2		
	6	401		2		44	6	4		8		43			
	8	428				29	5	4	3	6	8	22	2		
	10	281			4	25	3	2	7	6	3	39	1		
	12	491		1		50	11	8	4	12		41	1		
	14	47		2		4	2	5	1			1			
	16	220		1		41	8		1	5		21			
	18	8				1						24			
	20	447				52	7	5		9		42	3		
	24	274				30	7	5	1	6	9	21	6		
Total		3296		12	4	295	53	37	17	54	21	279	16		
INTERCONNECTING	3/4	20	20	1		1	1					2			
	1	929	460	22		73	1					72			
	1 1/2	230		8		22	2					30			
	2	702	380	10		46	3					30			
	2 1/2	120		1		6						4			
	3	340	290	4		20						8			
	4	557		6		32	18					18			
	6	1098	990	12		48	17					53			
	8	2195	180	23		46	26					54			
	10	271	55	4		16	8					10			
	12	310	310	5		26						10			
	14	30	30	1		2						2			
	18	30	30	1		2						2			
	20	30	30	1		2						2			
Total		6862	2775	99		342	76					297			
WTP	1/2	126				30									
	3/4	64				16									
	1	38				76									
	1 1/4	51	51			6	2		2			14		3	2
	1 1/2	6	6							2		12		2	
	2	129	129			28	4		2			34		2	2

	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admission
	3	184	184			30	10		6	2		58		13	6
	4	217	221			30	8		4	6		92		10	4
	6	109	111			12	4		4	4		50		8	2
	8	271	271			42	14		6	4		86		11	
	10	137	137			16		2		6		56		6	
	12	538	538			65	20		14	3		122		14	2
	14	96	96			12	8		3	10		65		13	
	16	4.5	4.5							3		15		3	
	18	57	57			6	2		3			17		3	
	20	44.5	44.5			4				3		19		3	
	24	32	32			6						4			
WTP Total		2104	1882			379	72	2	44	43		644		91	18
Grand Total		**12262**	**4657**	**111**	**4**	**1016**	**201**	**39**	**61**	**97**	**21**	**1220**	**16**	**91**	**18**

Table 11.10-2.: summary of piping by size.

11.10.5 Piping valves MTO

	Size (in)	Sum of Check Valve (qty)	Sum of Butterfly Valve (qty)	Sum of Globe Valve (qty)	Sum of Ball Valve (qty)	Sum of Electrovalve (qty)	Sum of Gate Valve (qty)
HYL	2						
	3			1			
	4			2			4
	6			4			9
	8			3			7
	10	2	1	2			8
	12	1	7	2			10
	14						
	16	1	5				2
	18						6
	20		5				6
	24						4
HYL Total		4	18	14			56

	Size (in)	Sum of Check Valve (qty)	Sum of Butterfly Valve (qty)	Sum of Globe Valve (qty)	Sum of Ball Valve (qty)	Sum of Electrovalve (qty)	Sum of Gate Valve (qty)
INTERCONNECTING	3/4						
	1			24			
	1 1/2			7			
	2			5			
	3						
	4						3
	6						3
	8			1			17
	10						1
	12						
	14						
	18						
	20						
	2.5			1			
Interconnecting Total				38			24
WTP	1/2	2			2		
	3/4				2		
	1				38		
	1 1/4	2	4			1	
	1 1/2		2				
	2	3	8			6	
	3	8	17			5	
	4	4	23			3	
	6	4	10				
	8	6	19			9	
	10		14				
	12	18	41			4	
	14	3	13				
	16		3				
	18	3	3				
	20		3				
	24		1				
WTP Total		53	161		42	28	
Grand Total		**57**	**179**	**52**	**42**	**28**	**80**

Table 11.10-3.: summary of piping valves

11.10.6 Piping MTO by material

ZONA	CARBON STEEL Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
HYL	2	146		2		4									
	3	99				1					1	4	1		
	4	454		4		14	4	4		2		21	2		
	6	401		2		44	6	4		8		43			
	8	428				29	5	4	3	6	8	22	2		
	10	220				17	3	2	3	6		39	1		
	12	481		1		48	11	8	2	11		41	1		
	14	47		2		4	2	5	1			1			
	16	200		1		33	7		1	5		21			
	18	8				1						24			
	20	447				52	7	5		9		42	3		
	24	153				14	6	5		4		20	6		
HYL Total		3084		12			261	51	37	10	51	9	278	16	
INTERCONNECTING	1	899	430	21		71						70			
	1	230		8		22	2					30			
	1/2														
	2	657	380	9		40	3					26			
	2	120		1		6						4			
	1/2														
	3	340	290	4		20						8			
	4	557		6		32	18					18			
	6	1042	990	11		48	17					28			
	8	235	180	8		20	4					22			

ZONA	CARBON STEEL Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
	10	271	55	4		16	8					10			
	12	310	310	5		26						10			
	14	30	30	1		2						2			
	18	30	30	1		2						2			
	20	30	30	1		2						2			
INTERCONNECTING Total		4751	2725	80		307	52					232			
WTP	1	38				76									
	1	51	51			6	2		2			14		3	2
	1/4														
	1	6	6							2		12		2	
	1/2														
	2	129	129			28	4		2			34		2	2
	3	184	184			30	10		6	2		58		13	6
	4	217	221			30	8		4	6		92		10	4
	6	109	111			12	4		4	4		50		8	2
	8	271	271			42	14		6	4		86		11	
	10	137	137			16		2		6		56		6	
	12	538	538			65	20		14	3		122		14	2
	14	96	96			12	8		3	10		65		13	
	16	4.5	4.5							3		15		3	
	18	57	57			6	2		3			17		3	
	20	44.5	44.5			4				3		19		3	
	24	32	32			6						4			
WTP Total		1914	1882			333	72	2	44	43		644		91	18
Grand Total		**9749**	**4607**	**92**		**901**	**175**	**39**	**54**	**94**	**9**	**1154**	**16**	**91**	**18**

Table 11.10-4.: Summary of carbon steel piping

STAINLES STEEL																
ZONA	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
HYL	10	61			4	8			4		3				
	12	10				2			2	1					
	16	20				8	1								
	24	121				16	1		1	2	9	1			
HYL Total		212			4	34	2		7	3	12	1			
INTERCONNECTING	3/4	20	20	1		1	1					2			
	1	30	30	1		2	1					2			
	2	45		1		6						4			
	8	30		1		6	1					4			
INTERCONNECTING Total		125	50	4		15	3					12			
Grand Total		**337**	**50**	**4**	**4**	**49**	**5**		**7**	**3**	**12**	**13**			

Table 11.10-5.: Summary of stainless steel piping

HDPE PIPING															
ZONA	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
INTERCONNECTING	6	56		1								25			
	8	1930		14		20	21					28			
INTERCONNECTING Total		1986		15		20	21					53			
Grand Total		**1986**		**15**		**20**	**21**					**53**			

Table 11.10-6.: summary of hdpe piping

11.10.7 Piping MTO by class and size

	Class	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
HYL	1A1	6	93		2		4	2					1			
	1A1 Total		93		2		4	2					1			
	1P2	12	124				3	2					2	1		
	1P2 Total		124				3	2					2	1		
	1P4	3	97				1					1		1		
		8	105				9	4		2	2	8				
		10	4				1						4			
		12	212				12	3	2		5		4			
	1P4 Total		418				23	7	2	2	7	9	8	1		
	1P5	3	2										4			
		4	24				4		2		2		15			
		6	158				22	2	4		6		24			
		8	323				20	1	4	1	4		22	2		
		10	208				15	3	2	1	6		20	1		
		12	25				6	1	2		2		6			
		14	47		2		4	2	5	1			1			
		16	99				10	2			2		2			
	1P5 Total		886		2		81	11	19	3	22		94	3		
	1S1	16	75				15						4			
	1S1 Total		75				15						4			
	3P1	6	19				3	2			2		8			
		18	8				1						24			
		20	447				52	7	5		9		42	3		
		24	153				14	6	5		4		20	6		
	3P1 Total		627				70	15	10		15		94	9		
	A01	2	146		2		4									
		4	430		4		10	4	2				6	2		
	A01 Total		576		6		14	4	2				6	2		
	M01	6	131				15						10			

	Class	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
		10	8				1			2			15			
		12	120		1		27	5	4	2	4		29			
		16	26		1		8	5		1	3		15			
	M01 Total		285		2		51	10	4	5	7		69			
	M02	10	61			4	8			4		3				
		12	10				2			2	1					
		16	20				8	1								
	M02 Total		91			4	18	1		6	1	3				
	SO4	24	121				16	1		1	2	9	1			
	SO4 Total		121				16	1		1	2	9	1			
HYL Total			3296		12	4	295	53	37	17	54	21	279	16		
INTERCONNECTING	C1A	1	410	410	11		20						22			
		2	462	380	5		22	1					12			
		3	290	290	3		18						6			
		4	82		1		6						2			
		6	900	900	6		32	13					16			
		8	70	70	1		6						2			
		10	25	25	1		4	3					4			
		12	280	280	4		24						8			
		18	30	30	1		2						2			
		20	30	30	1		2						2			
	C1A Total		2579	2415	34		136	17					76			
	C1B	1	267		4		36						32			
		1	105		3		8	2					10			
		1/2														
		2	130		2		10	2					6			
		3	50		1		2						2			
		4	343		3		14	13					10			
		6	12		1		4	1					4			
		8	40		2		4	4					8			
	C1B Total		947		16		78	22					72			
	C3A	1	20	20	1		1						2			

	Class	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
		6	90	90	3		6	2					6			
		8	110	110	4		8						8			
		10	30	30	1		2	1					2			
		12	30	30	1		2						2			
		14	30	30	1		2						2			
	C3A Total		310	310	11		21	3					22			
	C3H	1	202		5		14						14			
		1	125		5		14						20			
		1/2														
		2	65		2		8						8			
		2	120		1		6						4			
		1/2														
		4	132		2		12	5					6			
		6	40		1		6	1					2			
		8	15		1		2						4			
		10	216		2		10	4					4			
	C3H Total		915		19		72	10					62			
	H1F	6	56		1								25			
		8	1930		14		20	21					28			
	H1F Total		1986		15		20	21					53			
	S1A	3/4	20	20	1		1	1					2			
		1	30	30	1		2	1					2			
	S1A Total		50	50	2		3	2					4			
	S3G	2	45		1		6						4			
		8	30		1		6	1					4			
	S3G Total		75		2		12	1					8			
INTERCONNECTING Total			6862	2775	99		342	76					297			
WTP	C1A	1	38				76									
		1	51	51			6	2		2			14		3	2
		1/4														
		1	6	6							2		12		2	
		1/2														

	Class	Size (in)	Sum of Pipe (mts)	Sum of Insulation (mts)	Sum of Caps (qty)	Sum of Elbow 45° (qty)	Sum of Elbow 90° (qty)	Sum of Tee Normal (qty)	Sum of Tee Red (qty)	Sum of Conc Red	Sum of Ecc Red	Sum of Flange S.O (qty)	Sum of Flange WN qty	Sum of Blind Flange	Sum of Joint	Sum of Filter admision
		2	129	129			28	4		2			34		2	2
		3	184	184			30	10		6	2		58		13	6
		4	217	221			30	8		4	6		92		10	4
		6	109	111			12	4		4	4		50		8	2
		8	271	271			42	14		6	4		86		11	
		10	137	137			16		2		6		56		6	
		12	538	538			65	20		14	3		122		14	2
		14	45	45			6	6			10		48		10	
		18	57	57			6	2		3			17		3	
		20	44.5	44.5			4				3		19		3	
		24	32	32			6						4			
	C1A Total		1858.5	1827			327	70	2	41	40		612		85	18
	C3A	14	51	51			6	2		3			17		3	
		16	4.5	4.5							3		15		3	
	C3A Total		55.5	55.5			6	2		3	3		32		6	
	HOLD	1/2	126				30									
		3/4	64				16									
	HOLD Total		190				46									
WTP Total			2104	1882			379	72	2	44	43		644		91	18
Grand Total			**12262**	**4657**	**111**	**4**	**1016**	**201**	**39**	**61**	**97**	**21**	**1220**	**16**	**91**	**18**

Table 11.10-7.: summary of piping by class & size

11.10.8 Piping MTO by fluid and size

ZONA	Fluid Service	Size (in)	Count of Caps (qty)	Count of Pipe (mts)	Count of Insulation (mts)	Count of Tee Normal (qty)	Count of Joint	Count of Elbow 90° (qty)	Count of Blind Flange (qty)	Count of Hydrants (qty)	Count of Filter admision
HYL	AG			3		1		3			
	E	16		1				1			
	FW	6	1	1		1		1			
	IA	2	1	1				1			
		4	1	1		1		1	1		
	LS	6		2				2			
		10		2				1			
		12	1	5		3		4			
		16	1	1		1		1			
	M01	12		2		1		2			
	M02	16		1		1		1			
	NG	3		1				1	1		
		8		1		1		1			
	NI	12		1		1		1	1		
	PCWR	4		1							
		6		2				2			
		8		1				1			
	PG	6		1		1		1			
		18		2				1			
		20		11		3		10	2		
		24		2				2			
	PGW	24		2		2			2		
	QCWR	4		1							
		6		1				1			
		8		1				1			
		10		4		2		3	1		
		12		1		1		1			
		14	1	1		1		1			
		16		1		1		1			
	QCWS	3		1							

ZONA	Fluid Service	Size (in)	Count of Caps (qty)	Count of Pipe (mts)	Count of Insulation (mts)	Count of Tee Normal (qty)	Count of Joint	Count of Elbow 90° (qty)	Count of Blind Flange (qty)	Count of Hydrants (qty)	Count of Filter admision
		4		1				1			
		6		2		1		1			
		8		4		1		4	1		
		10		2				2			
		14		1		1		1			
		16		1		1		1			
	RS	16		2		2		2			
	RSH	10		1				1			
		12		1				1			
	SA	2	1	1				1			
		4	1	1		1		1	1		
	TG	8		1				1			
		10		1				1			
		12		2		1		2			
HYL Total			8	77		30		66	10		
INTERCONNECTING	DC	1	12	12	12	12		12			
		2	1	1	1	1		1			
		3	3	3	3	3		3			
		6	5	5	5	5		5			
		8	1	1	1	1		1			
	DE	3/4	1	1	1	1		1			
		1	1	1	1	1		1			
	EV	2	1	1	1	1		1			
		4	1	1	1	1		1			
	FW	6	1	1	1	1		1		1	
		8	14	14	14	14		14			
	IC	6	2	2	2	2		2			
		8	4	4	4	4		4			
		10	1	1	1	1		1			
		12	5	5	5	5		5			
		14	1	1	1	1		1			
		18	1	1	1	1		1			
		20	1	1	1	1		1			

ZONA	Fluid Service	Size (in)	Count of Caps (qty)	Count of Pipe (mts)	Count of Insulation (mts)	Count of Tee Normal (qty)	Count of Joint	Count of Elbow 90° (qty)	Count of Blind Flange (qty)	Count of Hydrants (qty)	Count of Filter admision
	IN	2	3	3	3	3		3			
		6	2	2	2	2		2			
		10	1	1	1	1		1			
	N2	2	1	1	1	1		1			
		4	1	1	1	1		1			
		6	1	1	1	1		1			
	NG	1	5	5	5	5		5			
		1 1/2	5	5	5	5		5			
		2	1	1	1	1		1			
		4	1	1	1	1		1			
		8	1	1	1	1		1			
		10	2	2	2	2		2			
		2 1/2	1	1	1	1		1			
	O2	2	1	1	1	1		1			
		8	1	1	1	1		1			
	PA	1	4	15	15	15		15			
		1 1/2	3	3	3	3		3			
		2	2	2	2	2		2			
		3	1	1	1	1		1			
		4	3	3	3	3		3			
		6	1	1	1	1		1			
		8	2	2	2	2		2			
INTERCONNECTING Total			99	110	110	110		110		1	
WTP	ANTICORROSIVE	1/2	2	2	2	2	2	2	2		
	ANTISCALANT	1/2	1	1	1	1	1	1	1		
	BIOCIDE	1/2	2	2	2	2	2	2	2		
	DC	2	1	1	1	1	1	1	1		
		4	2	2	2	2	2	2	2		

ZONA	Fluid Service	Size (in)	Count of Caps (qty)	Count of Pipe (mts)	Count of Insulation (mts)	Count of Tee Normal (qty)	Count of Joint	Count of Elbow 90° (qty)	Count of Blind Flange (qty)	Count of Hydrants (qty)	Count of Filter admision
		10	4	4	4	4	4	4	4		
	HIPOCLORITO	1/2	2	2	2	2	2	2	2		
	IC	1	18	18	18	18	18	18	18		
		1 1/4	3	3	3	3	3	3	3		1
		1 1/2	2	2	2	2	2	2	2		
		2	5	5	5	5	5	5	5		1
		3	13	13	13	13	13	13	13		3
		4	13	13	13	13	13	13	13		2
		6	10	10	10	10	10	10	10		1
		8	17	17	17	17	17	17	17		
		10	6	6	6	6	6	6	6		
		12	25	25	25	25	25	25	25		1
		14	14	14	14	14	14	14	14		
		16	3	3	3	3	3	3	3		
		18	4	4	4	4	4	4	4		
		20	4	4	4	4	4	4	4		
		24	1	1	1	1	1	1	1		
	SULPHURIC ACID	3/4	4	4	4	4	4	4	4		
WTP Total			156	156	156	156	156	156	156		9
Grand Total			**263**	**343**	**266**	**296**	**156**	**332**	**166**	**1**	**9**

Table 11.10-8.: summary of piping by fluid & size

REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	ACS	ACS	ACS	TEI
0	FOR INFORMATION	21 Jun 2016	ACS	ACS	ACS	TEI

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.11

BUILDING STEEL STRUCTURES MTO

3786-TARG-S-MT-000-004

ESC.: N/A | JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.11 Building Steel Structures MTO

The purpose of this document (hereinafter MT) is to report estimated quantities that shall be used for PIG IRON PRODUCTION PLANT cost estimation class 2 (hereinafter the Project), based on the technical documentation received from North Atlantic Iron Corporation (hereinafter NAIC or the Client) and developed by Tenova and Techint Engineering & Construction (hereinafter the Engineer of Record).

11.11.1 Scope

This MTO includes structural steel, miscellaneous steel and claddings, required for Mill Buildings at the Project. Main Buildings are listed as follows:

1. EAF Building
2. Pig Iron Building

This MTO excludes:

3. Iron Ore Pellets Dome
4. Transference Tower
5. Screening Tower
6. DRI Office
7. Bag House
8. Surge Bin
9. DRI Reactor Tower
10. Main Office
11. Hood Fume Extraction
12. Fume Duct Supports
13. Air Compressors Building
14. Substation Buildings
15. Others auxiliaries' buildings

11.11.2 Summary of building steel structures

CSA G40.21M, Gr350W				
X-Heavy Steel			1.482	ton
			50%	
Heavy Steel			422	ton
			14%	
Medium Steel			199	ton
			7%	
CSA G40.21M, Gr300W				
Heavy Steel			52	ton
			2%	
Medium Steel			243	ton
			8%	
Light Steel			593	ton
			20%	
Structural Steel			2991	ton
			96%	
Grating	1094	m²	55	ton
			42%	
Handrails	1980	m	40	ton
			30%	
Ladders	477	m	19	ton
			14%	
Stairs	107	m	18	ton
			14%	
Miscellaneous Steel			132	ton
			4%	
Erection Weights			**3122**	ton
Roofings			7.615	m²
			29%	
Sidings			18.799	m²
			71%	
Claddings			**26414**	m²
Painting			**59031**	m²

Table 11.11-1.: summary of building steel structures MTO

11.11.3 Premises

Material Take Off (MTO) present on following tables (refer to Annex A) are based on following premises:

a) Assumed values are reliable and based on existing plants in operation. Therefore, these values are considered as valid for this stage of the project, as well as the assumed weights per sqm for miscellaneous structures.
b) Mill buildings, like EAF building, was modelling in a steel analysis software and analyzed with preliminary topology and loads. For design criteria refer to 3786-TARG-S-DC-000-001 .
c) Site conditions shall be as per 3786-TARG-R-ME-000-001 .
d) Mill buildings columns are designed as fixed at the base.
e) Crane runway girders are designed as simple span girders.

Steel Structures shall be provided fully functional with all necessary components required for final installation, as bolting and fastening, welding consumables, seals (metallic or plastic), flashing and trims. These items are not shown in MT, but shall be considered by Steel Fabricator for its quotation and provision. These items shall not be valued separately. These items measures (weights or lengths) shall not be considered for payments.

Calculation of Weights. Unless otherwise specified, for contracts stipulating a price per kilo for fabricated structural steel that is delivered and/or erected, the quantities of materials for payment shall be determined by the calculation of the gross weight of materials as shown in the Shop Drawings . Coating, bolting and welding weights shall not be included in the calculated weight for the purposes of payment.

The unit weight of steel shall be taken as 7850 kg/m³ [490 lb/ft³]. The unit weight of other materials shall be in accordance with the manufacturer's published data for the specific product.

The weights of standard structural shapes, plates and bars shall be calculated on the basis of Shop Drawings that show the actual quantities and dimensions of material to be fabricated, as follows:

a) The weights of all standard structural shapes shall be calculated using the nominal weight per meter [mass per ft] and the detailed overall length.
b) The weights of plates and bars shall be calculated using the detailed overall final configuration and dimensions (by software).

c) When parts are cut from standard structural shapes, leaving a non-standard section that is not useable on the same contract, still the weight shall be calculated using the nominal weight per meter [mass per ft] and the detailed overall length.
d) Deductions shall not be made for material that is removed for cuts, copes, clips, blocks, drilling, punching, boring, slot milling, planning or weld joint preparation.

The weights of shop or field weld metal and protective coatings shall not be included in the calculated weight for the purposes of payment

This MTO do not include losses and margins of fabrication process, installation and re-work assembly.

This MT do not include any material for supports and temporary structures required for fabrication, transportation nor erection

This MT do not include any material for lifting like spreader beams/frames nor any other accessories to handling modules, packages nor steel members

Steel runway rails for overhead cranes are not included in this MT. These shall be specified and considered by crane vendor.

Standard supports for pipes, cable trays, panel boards, etc, and other special steel supports are not considered in this MTO.

Louvers, gates, doors, and other buildings accessories, are not considered in this document

Anchor Bolts: 2-1/2" diameter, quantities 160, for axis F and G; 2" diam., qty's 3, for axis H; 2-1/2" diam., qty's 108, for rows 8, 9 and 10. Material: ASTM F1554 Gr.105 or ASTM A193 B7. These items are not shown in MT, and shall be considered valued separatly. Anchor bolts shall be not provided by Steel Fabricator.

NOTES:

For design criteria and materials refer to 3786-TARG-S-DC-000-001 .
All steelworks shall be coated according to 3786-TARG-S-DC-000-001 .
For materials refer to 3786-TARG-S-DC-000-001 .
Equivalent welded shapes are permitted, only for profiles depth more than 300 mm.
All joint penetration welds (connections and slices) shall be 100% radiographed.

All bolt connections as per snug tight conditions, unless otherwise indicated such as runway girders.
Structural Steel Classification:
Steel runway rails for overhead crains are not included in this MT. These shall be specified and considered by crane vendor.

a) Lightweight type (metric tons), loose steel shapes until 30 kg/m,
b) Medium type (metric tons), loose steel shapes until 60 kg/m,
c) Hevavy type (metric tons), loose steel shapes until 90 kg/m,
d) X-heavy type (metric tons), loose steel shapes over than 90 kg/m.

All bolted structural connectiones shall be as per ASTM A325/A325M.
Stairs length indicated in Annex A , correspond to its vertical projection. Stairs include stringers (C10X15), handrails and treads. Do not include stair case. Standard weight 170 kg/m.
Railings shall be pipe type, with 1-1/2" sch 40 as handrails, posts and knee rail, and with 6x1/4" plate as toe plate. Standard weight 20 kg/m.
Gratings sizes shall be 32x5mm serrated bearing bar type with 30x100 mm mesh
MT does not include Surplus (losses and margins of fabrication process).
This MT do not include coating, bolting and consumables weights

11.11.4 Reference documents

1. 3786-TARG-R-ME-000-001 B SITE CONDITIONS
2. 3786-TARG-X-LY-000-002 0 GENERAL OF THE PLANT - SECTION A-A
3. 3786-TARG-X-LY-000-003 0 GENERAL OF THE PLANT - LAYOUT
4. 3786-TARG-X-LY-000-004 0 SURFACE BUILDING PLANT
5. 3786-TARG-X-LY-600-004 0 EAF AREA - LAYOUT - PLANS
6. 3786-TARG-X-LY-600-005 0 EAF AREA - LAYOUT - SECTIONS
7. 3786-TARG-X-LY-700-003 0 PIG IRON AREA - LAYOUT - PLAN
8. 3786-TARG-X-LY-700-004 0 PIG IRON AREA - LAYOUT - SECTIONS
9. 3786-TARG-X-LY-700-005 0 PIG IRON AREA - LAYOUT - SECTIONS
10. 3786-TARG-S-DC-000-001 0 STEEL STRUCTURES - DESIGN CRITERIA
11. 3786-TARG-S-SK-600-001 0 STEEL STRUCTURES - EAF BUILDING - SKETCH
12. 3786-TARG-S-SK-700-001 0 STEEL STRUCTURES - PIG IRON BUILDING - SKETCH

11.11.5 Building steel structure MTO

Rev	Item	Description	Structural Steel													Miscellaneous Steel									Claddings						
			CSA G40.21M, Gr350W						CSA G40.21M, Gr300W					A	Grating		Handrails		Caged Ladders		Stairs		B	Roofing		Siding		C	Painting*	Erection Weights
			Light	Medium	Heavy	X-Heavy	Plates		Light	Medium	Heavy	X-Heavy	Plates											Single	Thermo	Single	Thermo			A+B
			[m]	[m]	[m]	[m]	[m]		[m]	[m]	[m]	[m]	[m]	[m]	[m²]	[km]	[m]	[km]	[m]	[km]	[ea]	[km]	[m]	[m²]	[m²]	[m²]	[m²]	[m²]	[m²]	[m]
	1	EAF BUILDING (7 bays)	-	143,0	383,6	1.182,6	-	1.709	532,5	242,8	51,6	-	-	725,7	2.536	1.022	51,12	1.800	36,00	305	12,2	107	18,2	118	-	5.829	-	15.700	21.529	51222	2.654
0	1.10	EAF BUILDING - STRUCTURE (7 bays)	-	105,1	355,3	738,5	-	1.198,9	152,7	171,5	51,61	-	-	375,8	1.574,7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.781	1.574,7
0	1.11	EAF BUILDING - RUNWAY BEAMS	-	-	-	299,4	-	299,4	66,0	-	-	-	-	66,0	365,3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.302	365,3
0	1.12	EAF BUILDING - WALKWAYS	-	-	-	-	-	-	72,6	-	-	-	-	72,6	72,6	907	45,4	1.512	30,2	157	6,3	-	-	81,9	-	-	-	-	-	4.365	154,4
0	1.13	EAF BUILDING - STAIRS	-	-	-	-	-	-	-	64,3	-	-	-	64,3	64,3	-	-	-	-	-	-	107	18,2	18,2	-	-	-	-	-	1.608	82,5
0	1.15	EAF BUILDING - CLADDINGS	-	-	-	-	-	-	147,0	-	-	-	-	147,0	147,0	-	-	-	-	-	-	-	-	-	-	4.608	-	13.346	17.954	5.145	147,0
0	1.30	EAF BUILDING ANNEX - STRUCTURE (4 bays)	-	38,0	28,3	105,0	-	171,2	27,4	6,94	-	-	-	34,4	205,6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.699	205,6
0	1.31	EAF BUILDING ANNEX - RUNWAY BEAMS	-	-	-	39,7	-	39,7	27,6	-	-	-	-	27,6	67,4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.365	67,4
0	1.32	EAF BUILDING ANNEX - WALKWAYS	-	-	-	-	-	-	9,2	-	-	-	-	9,2	9,2	115	5,8	288	5,8	148	5,9	-	-	17,4	-	-	-	-	-	907	26,7
0	1.35	EAF BUILDING ANNEX - CLADDINGS	-	-	-	-	-	-	30,0	-	-	-	-	30,0	30,0	-	-	-	-	-	-	-	-	-	-	1.221	-	2.354	3.575	1.050	30,0
	2	PIG IRON BUILDING (3 bays)		55,83	38,8	299,6	-	394	60,5			-	-	60,46	455	72	3,6	180	3,6	172	6,9	-		14	-	1.786	-	3.099	4.885	7809	469
0	2.10	PIG IRON BUILDING - STRUCTURE	-	55,8	38,8	252,1	-	346,8	37,4	-	-	-	-	37,4	384,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.003	384,2
0	2.11	PIG IRON BUILDING - RUNWAY BEAMS	-	-	-	47,5	-	47,5	17,3	-	-	-	-	17,3	64,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.080	64,8
0	2.12	PIG IRON BUILDING - WALKWAYS	-	-	-	-	-	-	5,8	-	-	-	-	5,8	5,8	72	3,6	180	3,6	172	6,9	-	-	14,1	-	-	-	-	-	726	19,8
0	2.20	PIG IRON BUILDING - CLADDINGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.786	-	3.099	4.885	-	-
		TOTAL	-	199	422	1.482	-	2.104	593	243	52	-	-	887	2.991	1.094	55	1.980	40	477	19	107	18	132	-	7.615	-	18.799	26.414	59.031	3.122
			0%	6%	20%	70%	0%	70%	67%	27%	6%	0%	0%	30%	96%	42%		30%		14%		14%		4%	0%	29%	0%	71%	100%		100%
		STANDARDS	< 30 kg/m	< 60 kg/m	< 90 kg/m	> 90 kg/m			< 30 kg/m	< 60 kg/m	< 90 kg/m	> 90 kg/m				50 [kg/m²]		20 [kg/m]		40 [kg/m]		170 [kg/m]			4 [kg/m²]	10 [kg/m²]	4 [kg/m²]	10 [kg/m²]		19 [kg/m²]	

Table 11.11-2.: buildings steel structure MTO

NOTES

1. These quantities are from preliminary designs (pre-feasibility engineering).
2. All steelworks shall be provided with coating as required. Painting values are for reference only.
3. Anchor Bolts: 2-1/2" and 2" diam. Material: ASTM F1554 Gr.105 or ASTM A193 B7.

1	ISSUED	4/4/18	ACS	ACS	ACS	TEI
0	FOR INFORMATION	22 Jun 2016	ACS	ACS	ACS	TEI
REV.	**DESCRIPTION**	**DATE**	**PROJ.**	**EXEC.**	**CHECK.**	**APPR.**

Pure Fonte Ltée

PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

tenova

TECHINT

TENOVA

TECHINT ENGINEERING & CONSTRUCTION

SECTION 11 - MTO

CHAPTER 11.12

DRI TOWER STEEL STRUCTURES MTO

3786-TARG-S-MT-000-005

ESC.: N/A

JOB: CD-335

REVISION 1

REVISION

CONTENTS

FIGURES AND REFERENCES

11.12 DRI tower steel structure MTO

The purpose of this document (hereinafter MT) is to report estimated quantities that shall be used for PIG IRON PRODUCTION PLANT cost estimation class 2 (hereinafter the Project), based on the technical documentation received from PURE FONTE LTÉE and developed by Tenova and Techint Engineering & Construction (hereinafter the Engineer of Record).

11.12.1 Scope

This MTO includes structural steel for:

1. DRI reactor tower

11.12.2 Summary of building steel structures

CSA G40.21M, Gr350W				
X-Heavy Steel			471	*ton*
			42%	
Heavy Steel			284	*ton*
			26%	
Medium Steel			100	*ton*
			9%	
Light Steel			-	*ton*
			0%	
CSA G40.21M, Gr300W				
X-Heavy Steel			-	*ton*
			0%	
Heavy Steel			-	*ton*
			0%	
Medium Steel			192	*ton*
			17%	
Light Steel			62	*ton*
			6%	
Structural Steel			1107	*ton*
			90%	
Grating	1629	m²	81	*ton*
			67%	
Handrails	744	m	15	*ton*
			12%	
Ladders	127	m	5	*ton*
			4%	
Stairs	120	m	20	*ton*
			17%	
Miscellaneous Steel			122	*ton*
			10%	
Erection Weights			1229	*ton*
Roofings			14	*m²*
			1%	
Sidings			1.476	*m²*
			99%	
Claddings			1490	*m²*
Painting			20824	*m²*

Table 11.12-1.: summary of building steel structures MTO

11.12.3 Premises

Material Take Off (MTO) present on following tables (refer to Annex A) are based on following premises:

a) Assumed values are reliable and based on existing plants in operation. Therefore, these values are considered as valid for this stage of the project, as well as the assumed weights per sqm for miscellaneous structures.
b) Mill buildings, like EAF building, was modelling in a steel analysis software and analyzed with preliminary topology and loads. For design criteria refer to 3786-TARG-S-DC-000-001 .
c) Site conditions shall be as per 3786-TARG-R-ME-000-001 .
d) Mill buildings columns are designed as fixed at the base.
e) Crane runway girders are designed as simple span girders.

Steel Structures shall be provided fully functional with all necessary components required for final installation, as bolting and fastening, welding consumables, seals (metallic or plastic), flashing and trims. These items are not shown in MT, but shall be considered by Steel Fabricator for its quotation and provision. These items shall not be valued separately. These items measures (weights or lengths) shall not be considered for costs.

Calculation of Weights. Unless otherwise specified, for contracts stipulating a price per kilo for fabricated structural steel that is delivered and/or erected, the quantities of materials for payment shall be determined by the calculation of the gross weight of materials as shown in the Shop Drawings . Coating, bolting and welding weights shall not be included in the calculated weight for the purposes of cost.

The unit weight of steel shall be taken as 7850 kg/m³ [490 lb/ft³]. The unit weight of other materials shall be in accordance with the manufacturer's published data for the specific product.

The weights of standard structural shapes, plates and bars shall be calculated on the basis of Shop Drawings that show the actual quantities and dimensions of material to be fabricated, as follows:

a) The weights of all standard structural shapes shall be calculated using the nominal weight per meter [mass per ft] and the detailed overall length.
b) The weights of plates and bars shall be calculated using the detailed overall final configuration and dimensions (by software).

c) When parts are cut from standard structural shapes, leaving a non-standard section that is not useable on the same contract, still the weight shall be calculated using the nominal weight per meter [mass per ft] and the detailed overall length.
d) Deductions shall not be made for material that is removed for cuts, copes, clips, blocks, drilling, punching, boring, slot milling, planning or weld joint preparation.

The weights of shop or field weld metal and protective coatings shall not be included in the calculated weight for the purposes of cost

This MTO do not include losses and margins of fabrication process, installation and re-work assembly.

This MT do not include any material for supports and temporary structures required for fabrication, transportation nor erection

This MT do not include any material for lifting like spreader beams/frames nor any other accessories to handling modules, packages nor steel members

Steel runway rails for overhead cranes are not included in this MT. These shall be specified and considered by crane vendor.

Standard supports for pipes, cable trays, panel boards, etc, and other special steel supports are not considered in this MTO.

Louvers, gates, doors, and other buildings accessories, are not considered in this document

Anchor Bolts: 2-1/2" diameter, quantities 160, for axis F and G; 2" diam., qty's 3, for axis H; 2-1/2" diam., qty's 108, for rows 8, 9 and 10. Material: ASTM F1554 Gr.105 or ASTM A193 B7. These items are not shown in MT, and shall be considered valued separatly. Anchor bolts shall be not provided by Steel Fabricator.

NOTES:

For design criteria and materials refer to 3786-TARG-S-DC-000-001 .
All steelworks shall be coated according to 3786-TARG-S-DC-000-001 .
For materials refer to 3786-TARG-S-DC-000-001 .
Equivalent welded shapes are permitted, only for profiles depth more than 300 mm.
All joint penetration welds (connections and slices) shall be 100% radiographed.

All bolt connections as per snug tight conditions, unless otherwise indicated such as runway girders.
Structural Steel Classification:
Steel runway rails for overhead crains are not included in this MT. These shall be specified and considered by crane vendor.

a) Lightweight type (metric tons), loose steel shapes until 30 kg/m,
b) Medium type (metric tons), loose steel shapes until 60 kg/m,
c) Hevavy type (metric tons), loose steel shapes until 90 kg/m,
d) X-heavy type (metric tons), loose steel shapes over than 90 kg/m.

All bolted structural connectiones shall be as per ASTM A325/A325M.
Stairs length indicated in Annex A , correspond to its vertical projection. Stairs include stringers (C10X15), handrails and treads. Do not include stair case. Standard weight 170 kg/m.
Railings shall be pipe type, with 1-1/2" sch 40 as handrails, posts and knee rail, and with 6x1/4" plate as toe plate. Standard weight 20 kg/m.
Gratings sizes shall be 32x5mm serrated bearing bar type with 30x100 mm mesh
MT does not include Surplus (losses and margins of fabrication process).
This MT do not include coating, bolting and consumables weights

11.12.4 Reference documents

1. 3786-TARG-R-ME-000-001 0 SITE CONDITIONS
2. 3786-TARG-X-LY-000-002 0 GENERAL OF THE PLANT - SECTION A-A
3. 3786-TARG-X-LY-000-003 0 GENERAL OF THE PLANT - LAYOUT
4. 3786-TARG-X-LY-600-004 0 EAF AREA - LAYOUT - PLANS
5. 3786-TARG-X-LY-600-005 0 EAF AREA - LAYOUT - SECTIONS
6. 3786-TARG-S-DC-000-001 0 STEEL STRUCTURES - DESIGN CRITERIA

11.12.5 DRI tower steel structure MTO

Rev	Item	Description	Structural Steel													Miscellaneous Steel									Claddings						
			CSA G40.21M, Gr350W					CSA G40.21M, Gr300W						A		Grating		Handrails		Caged Ladders		Stairs		B	Roofing		Siding		C	Painting[1]	Erection Weights
			Light	Medium	Heavy	X-Heavy	Plates	Light	Medium	Heavy	X-Heavy	Plates													Single	Thermo	Single	Thermo			A+B
			[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]		[m]		[m²]	[km]	[m]	[km]	[m]	[km]	[m]	[km]	[m]	[m²]	[m²]	[m²]	[m²]	[m²]	[m²]	[m]
	1	DRI REACTOR TOWER	-	99,9	283,7	470,6	-	854	61,6	191,7	-	-	-	253,3	1.107	1.629	81,43	744	14,88	127	5,1	120	20,4	122	14	-	1.476	-	1.490	20824	1.229
A	1.10	DRI REACTOR TOWER - STRUCTURE	-	99,9	283,7	470,6	-	854,2	-	-	-	-	-	-	854,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.878	854,2
A	1.11	DRI REACTOR TOWER - STAIRS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	20,4	20,4	-	-	-	-	-	-	-	20,4
A	1.12	DRI REACTOR TOWER - CAGED LADDERS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	127	5,1	-	-	5,1	-	-	-	-	-	-	254	5,1
A	1.13	DRI REACTOR TOWER - PLATFORMS	-	-	-	-	-	-	40,0	191,7	-	-	-	231,7	231,7	1.629	81,4	744	14,9	-	-	-	-	96,3	-	-	-	-	-	-	6.936	328,0
A	1,14	DRI REACTOR TOWER - ELEVATOR	-	-	-	-	-	-	21,6	-	-	-	-	21,6	21,6	-	-	-	-	-	-	-	-	-	14	-	1.476	-	1.490	756	21,6
		TOTAL	-	100	284	471	-	854	62	192	-	-	-	253	1.107	1.629	81	744	15	127	5	120	20	122	14	-	1.476	-	1.490	20.824	1.229
			0%	12%	33%	55%	0%	77%	24%	76%	0%	0%	0%	23%	90%	67%		12%		4%		17%		10%	1%	0%	99%	0%	100%		100%
		STANDARDS	< 30 kg/m	< 60 kg/m	< 90 kg/m	> 90 kg/m			< 30 kg/m	< 60 kg/m	< 90 kg/m	> 90 kg/m				50 [kg/m²]		20 [kg/m]		40 [kg/m]		170 [kg/m]			4 [kg/m²]	10 [kg/m²]	4 [kg/m²]	10 [kg/m²]		18 [kg/m²]	

Table 11.12-2.: DRI tower steel structure MTO

NOTES

1. These quantities are from preliminary designs (pre-feasibility engineering).
2. All steelworks shall be provided with coating as required. Painting values are for reference only.
3. Anchor Bolts: 2-1/2" and 2" diam. Material: ASTM F1554 Gr.105 or ASTM A193 B7.