LBA CCS TRANSPORT AND STORAGE PROJECT

POINT OF AYR TO SATELLITE PLATFORMS

JACKET AND PILES - STRUCTURAL MTO
DOUGLAS CCS

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1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T/S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonisation project (the HyNet Project), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonising the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO_2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonisation is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO_2 storage is provided in depleted and well-known gas fields that are owned and operated by Eni UK.

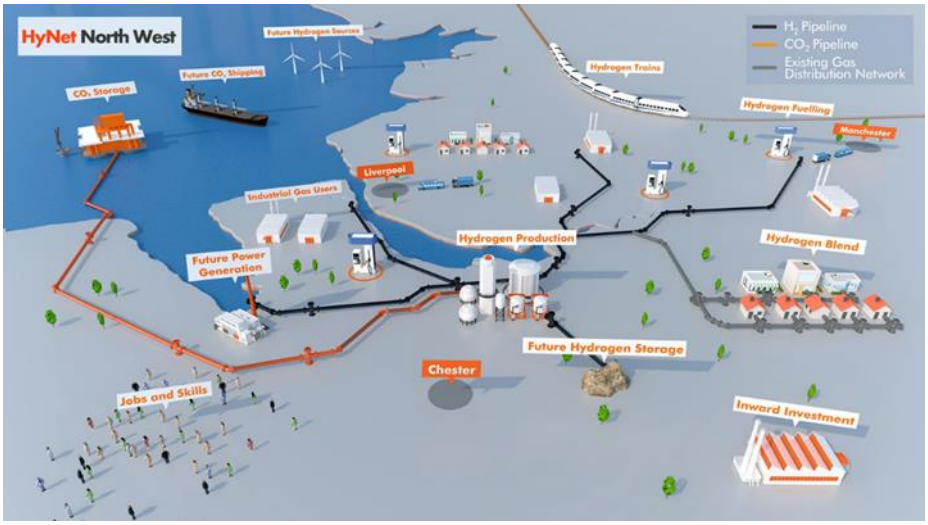


Figure 1-1 Hynet Project North West Project Overview

As part of Onshore Scope, CO_2 emissions from these sources will be transported along a new-build pipeline which will connect Ince Fertiliser Plant with Stanlow Refinery and then run from Stanlow Refinery to the south of Chester, and then on to the Flint AGI (Above Ground Installation) located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be re-purposed to become a CO_2 export pipeline and will transport the CO_2 to the existing Point of Ayr (PoA) gas terminal.

As part of offshore scope, the existing offshore natural gas import pipeline from PoA gas terminal will be re-purposed to become a CO_2 export pipeline. It was initially envisaged that the CO_2 export pipeline would transport CO_2 to the existing Douglas platform, however, this approach has since been revised to re-direct the CO_2 export pipeline to a new Douglas CCS platform within close proximity to the existing Douglas Complex.

From the new Douglas CCS platform, CO_2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

1.2 Scope of the Document

Scope of the document is to provide a preliminary summary of material quantities for steel pipes, plates, sections and other structural components of the new Douglas CCS platform jacket and piles.

The present material take off is based on FEED phase deliverables and it only aims to provide useful information for the quotation of material procurement and construction of the structure.

This MTO is based on the structural drawings reported in section 3.1 and estimated quantities for structural parts not explicitly detailed in the FEED phase of the project.

The risers, flanges and their coatings are not part of this MTO and will be included in the pipeline MTO.

1.3 Criteria for Material Take Off

MTO provided in the section below has been prepared in accordance with the following criteria:

- Except for joint cans and butt-welded pipes, the individual length of pipes and hot rolled beams is indicated as gross length (GL), defined as:

  $GL = OL + 50$ mm if $OL \leq 1000$ mm

  $GL = OL + 100$ mm if $OL > 1000$ mm

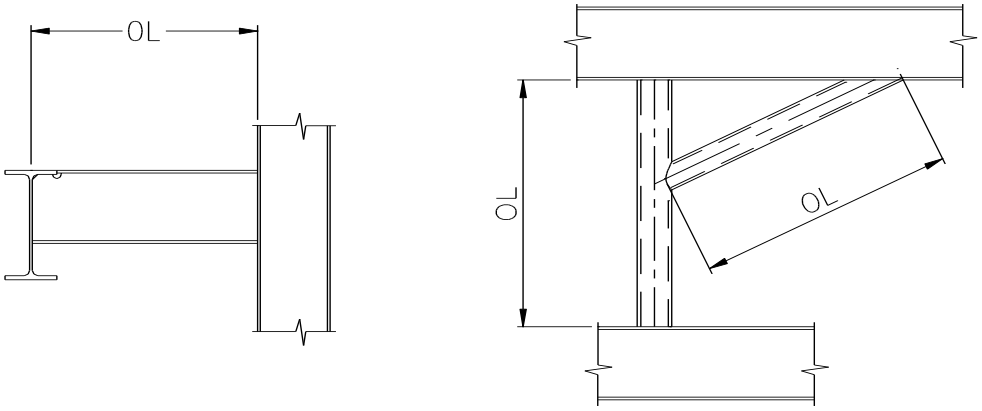
  where "OL" is the overall theoretical length as shown in the figure below

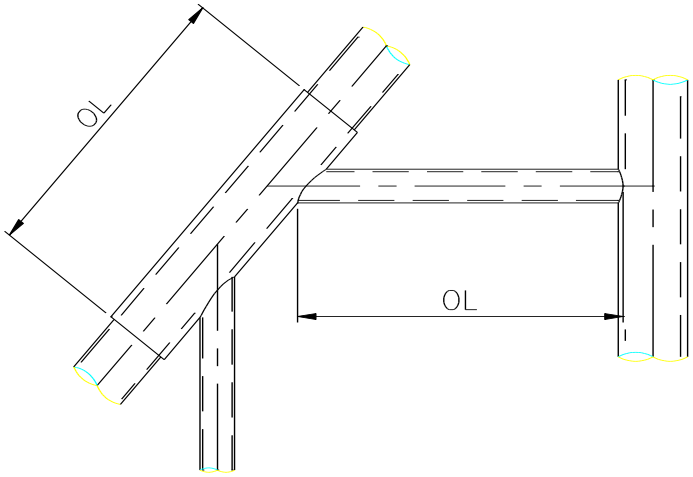
- For joint cans and butt-welded pipes the exact length is given.
- For plates and bars the exact quantities as reported in reference drawings are provided.

The steel material shall be in accordance with [Ref 4] and [Ref 5].

It is EPC Contractor responsibility to define the exact gross lengths needed to perform the fabrication activities.

No additional allowances for composition of bars, plates, tests, spares, are included in the provided quantities. E.P.C. contractor shall perform his own assessments to include the above.





2.0 DEFINITION AND ABBREVIATION

2.1 Definition

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e. Eni UK. COMPANY will generally specify technical requirements. The term "COMPANY" also includes agents or consultants authorized to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Contractor	A person or organization that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

2.2 Abbreviations

3D	Three Dimensional
AGI	Above Ground Installation
CBF	Current Blockage Factor
CCS	Carbon Capture and Storage
CO_2	Carbon dioxide
CoG	Centre of Gravity
DAF	Dynamic Amplification Factor
DOF	Degree of Freedom
FEED	Front-End Engineering Design
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
LBA	Liverpool Bay
MTO	Material Take Off
PoA	Point of Ayr
RSR	Reserve Strength Ratio
SCF	Stress Concentration Factor
SDOF	Single Degree of Freedom
SI	Structural Integrity
SMYS	Specified Minimum Yield Strength
t	Metric tonne
VIV	Vortex-Induced Vibration
UNO	Unless Noted Otherwise

3.0 REFERENCES

Refer to the Project List of Applicable Standard.

3.1 Project Documents

[Ref 1]	102100BGRB09002	Basis of Design Offshore
[Ref 2]	105600BORB90000	Structural Design Premises
[Ref 3]	105600BODE90130	Douglas CCS – Jacket – Drawings List and General Notes

3.2 Company Specifications

[Ref 4]	Eni, 08832.ENG.MME.SDS	General Specification Offshore Steel Structures, Revision 09, December 2020.
[Ref 5]	Eni, 08833.ENG.MME.SDS	Offshore Platforms Offshore Structures Construction, Revision 07, December 2019.

3.3 International Codes and Standards

The latest edition available at Contract Award date of the National and International Codes and Standards, shall apply.

4.0 MATERIAL TAKE OFF – DOUGLAS CCS TOPSIDE

A summary of steel quantities relevant to the structure of the new Douglas CCS Jacket and piles Structure is provided in Section 4.1. Sections 4.2 provide summary of the primary structures whilst 4.3 and 4.4 provide a summary of the sleeves and mud mats structures and foundation pile, respectively. Other structural items that have not been designed in this FEED stage are listed in Section 4.5.

Temporary transportation and installation structures such as grillage and sea-fastening, and rigging are not included in this MTO.

The risers, flanges and their coatings are not part of this MTO and will be included in the pipeline MTO.

4.1 Summary

The following table summarizes the weight of the required material foreseen for the fabrication of the Douglas CCS Topside structure.

Item	Material Quantities [t]
Jacket Main Structure	797.6
Sleeves & Mud Mats	310.1
Foundation Piles	712.9
Estimated Quantities	638.7
Total	**2459.3**

Details of the different items (including material type and relevant grade) are provided in the following sections.

4.2 Jacket Main Structures

4.2.1 Pipe Sections

Item	Size/ Diameter (mm)	Thickness (mm)	Material Type	OL-Overall Length (mm)	Extra Length (mm)	GL-Gross Length (mm)	Q.ty (n°)	Tot.GL (mm)	Tot. Weight (kg)
PIPE	Ø850	25	PL355-20/B	11362	100	11462	8	91697	46641
PIPE	Ø850	25	PL355-20/B	10362	100	10462	8	83697	42572
PIPE	Ø850	40	PL355-20Z/B	2000	0	2000	11	22000	17579
PIPE	Ø850	25	PL355-20/B	1938	100	2038	10	20382	10367
PIPE	Ø850	25	PL355-20/B	1925	100	2025	1	2025	1030
PIPE	Ø850	25	PL355-20/B	1938	100	2038	6	12229	6220
PIPE	Ø850	25	PL355-20/B	1925	100	2025	4	8000	4069
PIPE	Ø850	25	PL355-20/B	1936	100	2036	4	8143	4142
PIPE	Ø850	25	PL355-20/B	2218	100	2318	3	6954	3537
PIPE	Ø850	25	PL355-20/B	6568	100	6668	2	13336	6783
PIPE	Ø850	25	PL355-20/B	12636	100	12736	4	50946	25913
PIPE	Ø850	25	PL355-20/B	1936	100	2036	4	8043	4091
PIPE	Ø850	25	PL355-20/B	1925	100	2025	3	6075	3090
PIPE	Ø850	25	PL355-20/B	11636	100	11736	4	46946	23879
PIPE	Ø850	25	PL355-20/B	5568	100	5668	1	5668	2883
PIPE	Ø850	25	PL355-20/B	10786	100	10886	2	21772	11074
PIPE	Ø850	25	PL355-20/B	9786	100	9886	3	29658	15085
PIPE	Ø800	20	PL355-0/B	1426	100	1526	10	15263	5872
PIPE	Ø800	30	PL355-20Z/B	3000	0	3000	11	33000	18800
PIPE	Ø800	20	PL355-0/B	2382	100	2482	3	7445	2864
PIPE	Ø800	35	PL355-20Z/B	1600	0	1600	8	12800	8452
PIPE	Ø800	20	PL355-0/B	2700	100	2800	8	22400	8618
PIPE	Ø800	20	PL355-0/B	4755	100	4855	4	19420	7471
PIPE	Ø800	20	PL355-0/B	2382	100	2482	1	2482	955
PIPE	Ø800	30	PL355-20Z/B	3400	0	3400	1	3400	1937
PIPE	Ø800	35	PL355-20Z/B	3800	0	3800	8	30400	20073
PIPE	Ø800	35	PL355-20/B	2700	100	2800	6	16800	11093
PIPE	Ø800	20	PL355-0/B	1426	100	1526	6	9158	3523
PIPE	Ø800	20	PL355-0/B	6500	100	6600	4	26400	10157
PIPE	Ø800	20	PL355-0/B	2200	100	2300	4	9200	3539
PIPE	Ø800	20	PL355-0/B	1927	100	2027	3	6080	2339
PIPE	Ø800	20	PL355-0/B	1927	100	2027	1	2027	780
PIPE	Ø800	35	PL355-20/B	2500	100	2600	2	5200	3434
PIPE	Ø610	30	PL355-20Z/B	1600	0	1600	1	1600	687
PIPE	Ø610	20	PL355-0/B	3400	100	3500	2	7000	2037

Item	Size/ Diameter (mm)	Thickness (mm)	Material Type	OL-Overall Length (mm)	Extra Length (mm)	GL-Gross Length (mm)	Q.ty (n°)	Tot.GL (mm)	Tot. Weight (kg)
PIPE	Ø610	30	PL355-20Z/B	3100	0	3100	1	3100	1330
PIPE	Ø610	20	PL355-0/B	1405	100	1505	2	3011	876
PIPE	Ø610	20	PL355-0/B	11726	100	11826	2	23651	6883
PIPE	Ø610	20	PL355-0/B	13486	100	13586	2	27172	7907
PIPE	Ø610	20	PL355-0/B	3741	100	3841	4	15363	4471
PIPE	Ø610	30	PL355-20Z/B	3230	0	3230	4	12920	5544
PIPE	Ø610	20	PL355-0/B	6515	100	6615	4	26460	7700
PIPE	Ø610	30	PL355-20Z/B	4100	0	4100	1	4100	1759
PIPE	Ø610	20	PL355-0/B	2150	100	2250	2	4500	1310
PIPE	Ø610	20	PL355-0/B	13486	100	13586	2	27172	7907
PIPE	Ø610	20	PL355-0/B	2481	100	2581	2	5161	1502
PIPE	Ø610	20	PL355-0/B	6945	100	7045	2	14090	4100
PIPE	Ø610	30	PL355-20Z/B	2300	0	2300	2	4600	1974
PIPE	Ø1400	65	PL355-40ZX/B	6482	0	6482	5	32409	69355
PIPE	Ø1400	60	PL355-40X/B	13290	100	13390	4	53560	106198
PIPE	Ø1400	70	PL355-40ZX/B	5860	0	5860	4	23440	53818
PIPE	Ø1400	50	PL355-20/B	17177	100	17277	4	69107	115039
PIPE	Ø1400	65	PL355-40ZX/B	1031	0	1031	5	5157	11037
PIPE	Ø1400	65	PL355-40ZX/B	5531	0	5531	4	22126	47350
								TOTAL	**797646**

4.3 Sleeves and Mud Mats

4.3.1 Pipe Sections

Item	Size/ Diameter (mm)	Thickness (mm)	Material Type	OL-Overall Length (mm)	Extra Length (mm)	GL-Gross Length (mm)	Q.ty (n°)	Tot.GL (mm)	Tot. Weight (kg)
PIPE	Ø1725	25	PL355-20/B	6825	100	6925	4	27700	29033
PIPE	Ø1725	25	PL355-20/B	800	50	850	4	3400	3564
PIPE	Ø1725	25	PL355-20/B	7725	100	7825	4	31300	32806
PIPE	Ø1765	35	PL355-20/B	925	50	975	8	7800	11647
PIPE	Ø1765	45	PL355-20/B	1925	100	2025	8	16200	30923
PIPE	Ø406.4	12.7	TB355-0/D	1256	100	1356	15	20346	2509
PIPE	Ø406.4	12.7	PL355-0/D	350	50	400	16	6400	789
PIPE	Ø406.4	12.7	TB355-0/D	1256	100	1356	1	1356	167
PIPE	Ø850	30	PL355-20/B	1107	100	1207	8	9653	5856
PIPE	Ø850	30	PL355-20/B	1061	100	1161	8	9288	5635
								TOT	**122929**

4.3.2 Cones

Item	Size/ Diameter (mm)	Thickness (mm)	Material Type	OL-Overall Length (mm)	Extra Length (mm)	GL-Gross Length (mm)	Q.ty (n°)	Tot.GL (mm)	Tot. Weight (kg)
CONE PLATE	Ø1725*3461	35	PL355-20/B	1500	0	1500	8	12000	17618

4.3.3 Plates

Item	Thickness (mm)	Material Type	Area (m^2)	Q.ty (n°)	Tot. Area (m^2)	Tot. Weight (kg)
PLATE	20	PL355-0/B	3.14	4	12.54	1969
PLATE	25	PL355-0/B	1.29	4	5.15	1010
PLATE	25	PL355-0/B	0.89	16	14.29	2804
PLATE	25	PL355-0/B	26.23	8	209.82	41178
PLATE	25	PL355-0/B	0.78	8	6.26	1229
PLATE	25	PL355-0/B	21.83	4	87.33	17139
PLATE	20	PL355-0/B	1.50	8	11.96	1877
PLATE	20	PL355-0/B	1.07	4	4.30	675
PLATE	8	PL355-0/B	0.01	128	1.73	109
PLATE	20	PL355-0/B	0.28	8	2.26	355
PLATE	20	PL355-0/B	0.66	8	5.31	834
PLATE	20	PL355-0/B	0.51	8	4.06	637
PLATE	20	PL355-0/B	1.20	8	9.62	1511
PLATE	20	PL355-0/B	1.28	8	10.27	1612
PLATE	25	PL355-0/B	0.79	16	12.62	2477
PLATE	25	PL355-20/D	64.70	4	258.79	50787
PLATE	20	PL355-0/D	0.57	8	4.53	712
PLATE	20	PL355-0/D	1.27	4	5.09	799
PLATE	25	PL355-20/D	1.16	4	4.63	908
PLATE	15	PL355-0/D	1.46	4	5.82	685
PLATE	25	PL355-20/D	0.52	4	2.08	409
PLATE	15	PL355-0/D	0.71	4	2.85	336
PLATE	25	PL355-20/D	1.09	8	8.71	1708
PLATE	15	PL355-0/D	1.40	8	11.18	1316
PLATE	25	PL355-20/D	0.47	4	1.88	370
PLATE	15	PL355-0/D	0.72	4	2.88	339
PLATE	25	PL355-20/D	0.47	4	1.89	370
PLATE	15	PL355-0/D	0.72	4	2.88	339
PLATE	25	PL355-20/D	1.02	4	4.08	801
PLATE	15	PL355-0/D	1.34	4	5.36	631
PLATE	25	PL355-20/D	0.42	4	1.69	331
PLATE	15	PL355-0/D	0.73	4	2.91	342

Item	Thickness (mm)	Material Type	Area (m^2)	Q.ty (n°)	Tot. Area (m^2)	Tot. Weight (kg)
PLATE	20	PL355-0/D	0.39	8	3.10	486
PLATE	20	PL355-0/D	2.51	8	20.11	3157
PLATE	25	PL355-20/D	1.38	4	5.53	1085
PLATE	15	PL355-0/D	1.61	4	6.43	757
PLATE	25	PL355-20/D	0.17	24	4.00	784
PLATE	15	PL355-0/D	0.24	24	5.86	690
PLATE	25	PL355-20/D	0.59	8	4.73	928
PLATE	15	PL355-0/D	0.69	8	5.51	648
PLATE	25	PL355-20/D	0.28	16	4.48	879
PLATE	25	PL355-20/D	0.23	64	14.61	2866
PLATE	15	PL355-0/D	0.36	64	23.24	2737
PLATE	25	PL355-20/D	0.39	12	4.62	906
PLATE	15	PL355-0/D	0.55	12	6.60	778
PLATE	20	PL355-0/D	0.44	8	3.55	558
PLATE	25	PL355-20/D	0.30	8	2.37	464
PLATE	15	PL355-0/D	0.45	8	3.57	421
PLATE	25	PL355-20/D	0.21	8	1.67	328
PLATE	15	PL355-0/D	0.35	8	2.76	325
PLATE	25	PL355-20/D	0.13	8	1.00	197
PLATE	15	PL355-0/D	0.25	8	1.98	233
PLATE	25	PL355-20/D	1.52	8	12.16	2386
PLATE	15	PL355-0/D	1.85	8	14.76	1738
PLATE	25	PL355-20/D	0.28	8	2.26	443
PLATE	15	PL355-0/D	0.33	8	2.61	307
PLATE	15	PL355-0/D	0.19	16	3.09	364
PLATE	25	PL355-20/D	1.66	4	6.63	1300
PLATE	15	PL355-0/D	2.08	4	8.33	981
PLATE	25	PL355-20/D	0.07	8	0.58	113
PLATE	15	PL355-0/D	0.08	8	0.66	78
PLATE	20	PL355-0/D	1.30	8	10.40	1632
PLATE	20	PL355-0/D	1.40	4	5.59	878
PLATE	10	PL355-0/D	0.00	178	0.68	53
PLATE	10	PL355-0/D	0.82	8	6.55	514
PLATE	10	PL355-0/D	0.95	4	3.81	299
PLATE	10	PL355-0/D	0.33	8	2.62	206
PLATE	10	PL355-0/D	0.32	24	7.59	596
PLATE	10	PL355-0/D	0.67	4	2.69	211
PLATE	10	PL355-0/D	0.96	4	3.82	300
PLATE	10	PL355-0/D	0.43	8	3.40	267
PLATE	10	PL355-0/D	0.98	8	7.83	615

Item	Thickness (mm)	Material Type	Area (m^2)	Q.ty (n°)	Tot. Area (m^2)	Tot. Weight (kg)
PLATE	10	PL355-0/D	1.06	4	4.23	332
PLATE	15	PL355-0/D	0.11	12	1.28	151
					TOTAL	**169590**

4.4 Pile Foundations

4.4.1 Pipe Sections

Item	Size/ Diameter (mm)	Thickness (mm)	Material Type	OL-Overall Length (mm)	Extra Length (mm)	GL-Gross Length (mm)	Q.ty (n°)	Tot.GL (mm)	Tot. Weight (kg)
PIPE	Ø1524	65	TB355-40/C	38000	100	38100	8	304800	712858

4.5 Estimated Quantities

The following material quantities relevant to other structural elements have been estimated.

Item	Material Quantity [t]
Zodiac Landings, Fenders, Ladders and Support	27.9
Walkways and rest landing platforms at top of jacket	4.4
Caissons & Supports	151.6
J-tubes & Supports	41.7
Risers supports and Clamps	21.4
Lifting Trunnions	9.8
Levelling Trunnions	9.6
CPM system, Caisson and Supports	14.5
Anodes	83.4
Grouting System	12.0
Paint	6.0
Shim plate and weld beads	10.8
Jacket extra length at the top	4.7
Pile Grippers	19.2
Grout Seals	4.8
Grout	167
Temporary rigging platform	50.0
TOTAL	**638.7**

Temporary Transportation and installation structures such as grillage and sea-fastening, and rigging are not included in this MTO.

The risers, flanges and their coatings are not part of this MTO and will be included in the pipeline MTO.