TTE Training Ltd.

Phase 2 Broad Base Record of Achievement

Academic Year: 2024-2025

Name: _____

2024 ROSPA President's Award

BRITISH SAFETY COUNCIL Five Star Occupational Health and Safety Audit 2023

BRITISH SAFETY COUNCIL International Safety Awards 2024 Merit

Ofsted Outstanding Provider

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STATEMENT OF INTENT

THE COMPETENCIES RECORDED IN THIS DOCUMENT ARE FOR A RANGE OF TASKS PERFORMED AND ASSESSED IN A TRAINING ENVIRONMENT SUPPORTED BY ANY NECESSARY UNDERPINNING KNOWLEDGE AND UNDERSTANDING

THEY FORM THE BASIC FOUNDATION LEADING TO FULL ASSESSMENT WHEN ON SITE.

BROAD BASED
RECORD OF ACHIEVEMENT FOR THE APPRENTICESHIP STANDARDS

PHASE 2

Name of Trainee:…….

VALIDATION

The above named trainee has completed all the training modules detailed in this Record of Achievement

Signed: ..... *Print:* .....
(Training Manager or delegated signatory)

Date: ……

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BROAD BASE

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TTE TRAINING LTD.

PHASE I RECORD OF ACHIEVEMENT BOOK

GUIDANCE NOTES

1. COURSE MARK

Either a course average, pass, or not applicable (N/A) statement to be entered as appropriate, (where an average is entered, 70% is the required minimum standard). An entry is only made in this box when either the pass mark is achieved, or if no further opportunities are available, the acronym FTR may be used to denote 'further training required' to achieve the required standard. For course detail see the relevant success criteria.

2. ASSESSOR SIGNATURE

3. Demonstrates that the individual has successfully completed a subject, or an activity related to a particular subject, and has been assessed by the Training Officer and confirms that the individual has achieved the required standard as set out in the Record Of Achievement. An (R) entered into this box may be used to denote that a re-assessment was required to achieve the required standard.

In the event of the absence of a signature, or the presence of "FTR", the Trainee Mentor/Training Officer should consult the Training Manager prior to the completion of the Phase II training period. Should there be insufficient time available arrangements may be made with the relevant employer for the trainee to return to TTE to complete the work. Alternatively a cross is to be inserted to prevent any future alterations.

4. DATE OF ENDORSEMENT

Accompanies the Training Officer signature that indicates when the trainees' work was assessed as "Completed" or "Not completed".

5. VALIDATION

To be completed by the Training Manager (or a delegated signatory) when all sections of the Record of Achievement have been completed, (note, there may be occasions when this may occur beyond the Phase II period)

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SECTION 1

RECORDS OF ACHIEVEMENT

SATISFACTORY KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING SUBJECTS HAS BEEN DEMONSTRATED VIA OBSERVATION OF PRACTISE AND THE COMPLETION OF PRACTICAL AND WRITTEN ASSIGNMENTS AND TESTS.

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RECORD OF ACHIEVEMENT – PHASE II

BROAD BASED (ELECTRICAL)

This Record of Achievement is to be completed by the Training Officer once the trainee has achieved the required standard, having completed all practical and written units relevant to the subject area, and may therefore be deemed competent only in a training environment as outlined in the subject synopsis.

The expected delivery plan for these modules is set out below

This is a Record of: .....……..... whose training started: …..... Employed by: .....

Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
32	E24	WORKSHOP SAFETY			S1-3 S4 S7 S8 S9 S11 S10 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 45 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
33	E25	ELECTRICAL ISOLATION OF EQUIPMENT			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
33	E26	ELECTRICAL EQUIPMENT – DISTRIBUTION & PROTECTION			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
34	E27	TRANSFORMERS			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
		1ST CAROUSEL END TEST						
		1ST CAROUSEL AVERAGE						

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Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
35	E28	CABLES & GLANDS			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
35	E29	TRACE HEATING			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
36	E30	BATTERIES			S1-3 S4 S7 S8 S9 S10 S11 S12 S13 S14 S15 S17	3 4 5 9 14 16 26 27 28 29 34-37 38 39 40 43 44 45 47 48 50 51 52 53 54 59	S4-6 S7 S8	21 22 23 27 44 45
		2ND CAROUSEL END TEST						
		2ND CAROUSEL AVERAGE						

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Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
36	E31	MOTORS			S1-3 S4 S7 S8 S9 S10 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 45 47 48 50 51 52 53 59	S1-3 S4-6 S7 S8	17 21 22 23 27 44 45
37	E32	MOTOR CONTROL			S1-3 S4 S7 S8 S9 S11 S12 S13 S14 S15 S17	3 4 5 9 26 27 28 29 34-37 38 39 40 43 44 47 48 50 51 52 53 59	S4-6 S7 S8	21 22 23 27 44 45
38	E33	ELECTRICAL DRAWINGS			S16 S17	56 57 59		
		3RD CAROUSEL END TEST						
		3RD CAROUSEL AVERAGE						
		END TEST RESULT						

VALIDATION: The above training has / has not* been completed to the specified success criteria.

Signed:..... *Print*: .....
(Training Officer)

Signed:..... *Print*: .....
(Trainee)

***Additional Training Officer Comments/Reasons for training incomplete**

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RECORD OF ACHIEVEMENT – PHASE II

BROAD BASED (INSTRUMENTS)

This Record of Achievement is to be completed by the Training Officer once the trainee has achieved the required standard, having completed all practical and written units relevant to the subject area, and may therefore be deemed competent only in a training environment as outlined in the subject synopsis.

The expected delivery plan for these modules is set out below

This is a Record of: .....……..... whose training started: …..... Employed by: .....

Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
40	I13	WORKSHOP SAFETY			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S17	1 3 4 5 7 8 17 27 29 30 31 34 35 36 37 39 43 44 47 48 51 58 59 60	S1-3 S4-6 S7	3 19 21 22 23 25 26 27 30 39 40 41 42 44
41	I14	INSTRUMENT EQUIPMENT, SYSTEMS and CALIBRATION			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S13 S16 S17	1 3 4 5 8 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 51 55 56 57 58 59 60	S1-3 S4-6 S7 S8	7 7 11 12 13 14 15 18 19 21 22 23 26 27 29 35 39 40 41 42 43 44 45
42	I15	PROCESS ANALYSERS (QMI)			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S17	1 3 4 5 8 21 27 29 30 31 34 35 36 37 39 43 44 47 48 58 59 60	S1-3 S4-6 S7	19 21 22 23 26 27 37 39 40 41 42 44
43	I16	HAZARDOUS AREA EQUIPMENT			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S15 S17	1 3 4 5 7 8 13 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 53 58 59 60	S1-3 S4-6 S7	1 19 21 22 23 25 26 27 29 31 39 40 41 42 43 44
44-45	I17	CONTROL & SHUTDOWN VALVES			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S13 S15 S16 S17	1 3 4 5 7 8 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 51 53 55 58 59 60	S1-3 S4-6 S7	3 4 5 8 9 12 13 14 15 17 18 19 21 22 23 25 26 27 28 29 39 40 41 42 43 44 46
46	I18	PROCESS CONTROL – THEORY AND APPLICATIONS			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S16 S17	1 3 4 5 7 8 27 28 29 30 31 34 35 36 37 39 43 44 47 48 57 58 59 60	S1-3 S4-6 S7	4 5 6 8 9 18 19 21 22 23 25 26 27 29 39 40 41 42 43 44
47	I19	PROCESS CONTROLLERS IN PRACTICE			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S17	1 3 4 5 7 8 27 28 29 30 31 34 35 36 37 39 43 44 47 48 58 59 60	S1-3 S4-6 S7	3 4 5 6 19 21 22 23 2526 27 39 40 41 42 43 44 46
48	I20	DISTRIBUTIVE CONTROL SYSTEMS (DCS)			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S17	1 3 4 5 8 7 27 28 29 30 31 34 35 36 37 39 43 44 47 48 58 59 60	S1-3 S4-6 S7	6 18 19 21 22 23 25 26 27 39 40 41 42 43 44
49	I21	SHUTDOWN/ TRIP / SAFETY SYSTEMS			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S13 S17	1 3 4 5 7 8 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 51 58 59 60	S1-3 S4-6 S7	6 8 9 12 13 14 15 18 19 21 22 23 25 26 27 29 39 40 41 42 43 44 46

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Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
50	I-22	DIGITAL TECHNOLOGY (HART and FIELDBUS)			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S13 S17	1 3 4 5 8 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 58 59 60	S1-3 S4-6 S7	18 19 21 22 23 26 27 39 40 41 42 43 44
50	I-23	PLANT MAINTENANCE			S1-3 S4 S5 S6 S7 S8 S9 S11 S12 S13 S17	1 3 4 5 8 27 28 29 30 31 34 35 36 37 39 40 41 42 43 44 47 48 58 59 60	S1-3 S4-6 S7	6 8 9 12 13 14 15 18 19 21 22 23 25 26 27 29 39 40 41 42 43 44 46
		END TEST RESULT						

VALIDATION: The above training has / has not* been completed to the specified success criteria.

Signed:……. *Print*:……..
(Training Officer)

Signed:……. *Print*: ……..
(Trainee)

***Additional Training Officer Comments/Reasons for training incomplete**

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RECORD OF ACHIEVEMENT – PHASE II

BROAD BASED (MECHANICAL)

This Record of Achievement is to be completed by the Training Officer once the trainee has achieved the required standard, having completed all practical and written units relevant to the subject area, and may therefore be deemed competent only in a training environment as outlined in the subject synopsis.

The expected delivery plan for these modules is set out below

This is a Record of: .....……..... whose training started: …..... Employed by: .....

Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
52	ME1	WORKSHOP SAFETY (PROCEDURES & PRACTICES)			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59	S1-3 S4-6	12 13 14 15 17 19 21 22 23 25 27 28 37
53-54	ME2	JOINTS (MATERIALS & COMPOUNDS)			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
55	ME3	VALVES			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6 S7	12 13 14 15 17 22 23 27 28 29 37 44
56-57	ME5	PUMPS & PUMPING			S1-3 S4 S5 S9 S12 S17	1-5 , 9, 26, 27-29, 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6 S7	12 13 14 15 17 22 23 27 28 29 37 44
58	ME8	ALIGNMENT METHODS & PRACTICE			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
59	ME9	RECIPROCATING COMPRESSORS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48, 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
59	ME10	CENTRIFUGAL COMPRESSORS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48, 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
60	ME11	ROTARY COMPRESSORS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48, 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
60	ME12	BEARINGS & BUSHES			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6 S7	12 13 14 15 17 22 23 27 28 29 37 44
61-62	ME13	LUBRICATION (FLUIDS & METHODS)			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37 40-44, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
63-64	ME14	MECHANICAL GLANDS & SEALS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6 S7	12 13 14 15 17 22 23 27 28 29 37 44

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Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
65	ME15	PRESSURE VESSELS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
66	ME16	RELIEF STREAMS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 56, 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
67	ME17	HEAT EXCHANGERS			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
68	ME18	MACHINE GUARDS & GUARDING			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59		
69	ME19	CONDITION MONITORING			S1-3 S4 S5 S9 S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 48 59-60 59	S1-3 S4-6	12 13 14 15 17 22 23 27 28 29 37
70	ME20	DIAGNOSTIC SKILLS			**S1-3 S4 S5 S9** S12 S17	1-5 9, 26, 27-29 30-31, 34-37, 40-44, 47, 48 59-60 59	S1-3 S4-6 S7	12 13 14 15 17 22 23 27 28 29 37 44
		END TEST RESULT						

VALIDATION: The above training has / has not* been completed to the specified success criteria.

Signed: …… *Print*: ……
(Training Officer)

Signed: …….. *Print*: ……..
(Trainee)

***Additional Training Officer Comments/Reasons for training incomplete**

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RECORD OF ACHIEVEMENT – PHASE II

BROAD BASED (PROCESS)

This Record of Achievement is to be completed by the Training Officer once the trainee has achieved the required standard, having completed all practical and written units relevant to the subject area, and may therefore be deemed competent only in a training environment as outlined in the subject synopsis.

The expected delivery plan for these modules is set out below

This is a Record of: .....……..... whose training started: ….....Employed by : .....

Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
72	P17	INTRODUCTION TO PROCESS RIG OPERTATIONS			S1-3 S17	7 8	S4-6	24 26
73	P18	PERMIT TO WORK			S1-3 S7 S8 S9 S10 S12 S13 S16 S17	1 5 6 7 8 37 38 39 40 42 44 45 48 51 55	S1-3 S4-6	12 15 19 23 24 25 26
73	P19	LOCK OUT TAG OFF			S7 S8 S9 S12 S16 S17	37 38 39 40 43 44 48 55	S1-3	12
74	P20	HAZARDS OF NITROGEN IN INDUSTRY			S7 S8 S12 S16 S17	6 7 8 13 37 38 39 48 55	S1-3 S4-6	1 12 26 24 26 31
75	P21	BASIC GENERIC INTRODUCTION TO CONFINED SPACE			S7 S8 S12 S16 S17	5 6 7 8 13 37 38 39 48 55	S1-3 S4-6	1 12 24 25 26 31
76	P22	PREPARATION FOR MAINTENANCE			S8 S10 S12 S17	38 39 41 42 45 48	S1-3	11 12 15 17
77	P23	DISTILLATION RECAP & BASIC TOWER OPERATIONS			S17			
78	P24	PRESTART, START UP , OPERATION & SHUTDOWN OF A TYPICAL BASIC VACUM DISTILLATION SYSTEM			S7 S11 S17	35 47	S1-3	2 3 4 5 6 8 9 14
79	P25	DISTILLATION SIMULATION			S4 S11 S17	27 28 29 47	S1-3	2 3 4 5 8 9 14 44
80	P26	EVAPORATOR SIMULATION			S4 S7 S11 S17	27 28 29 47	S1-3	2 3 4 5 8 9 14 44
80	P27	PACKED COLUMN			S1-3 S4 S7 S8 S9 S11 S14 S15 S17	11 27 28 29 34 38 39 40 44 47 52 53 59	S1-3	23 29
81	P28	OPERATIONAL PLANT – HANDOVER PROCEDURES			S1-3 S8 S13 S17	7 38 39 50 59	S1-3	7 11
82	P29	HEAT EXCHANGER SIMULATOR			S4 S7 S11 S17	27 28 29 35 47 59	S1-3	2 3 4 5 8 9 14 44
82	P30	HEAT BALANCE CALCULATIONS			S17	59		
83	P31	LEGIONELLA SAMPLING			S1-4 S4 S11 S17	6 7 8 27 49 59	S1-3	24 25 26
83	P32	STAINLESS STEEL COLUMN			S1-3 S7 S9 S11 S12 S14 S17	11 28 29 34 37 40 41 44 48 49 52 53	S1-3 S7	12 14 29 44

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Pg No	Module No	Module Title	Course Mark/ Completed	Date	Maintenance Std Ref	WBL Ref:	Manufacturing Std Ref	WBL Ref:
84	P33	MANAGING AN OPERATIONAL PLANT			S1-3 S13 S15 S17	5 7 9 10 50 59	S1-3	7 11 23 25 27 28
85	P34	WORKING WITH CENTRIFUGAL PUMPS			S11 S15 S17	4 9 53 59		
85	P35	WORKING WITH POSITIVE DISPLACEMENT PUMPS			S11 S15 S17	4 9 53 59		
86	P36	WORKING WITH STEAM TURBINES AS PRIME MOVERS			S11 S15 S17	4 9 53 59		
87-88	P37	WORKING WITH INDUSTRIAL COMPRESSORS			S11 S15 S17	4 9 53 59		
89	P38	COMPRESSOR SIMULATION			S4 S7 S11 S17	27 28 29 35 49	S1-7 S7	2 3 5 7 8 9 12
90-91	P39	PROCESS FURNACES			S11 S17	49		44
92	P40	CALCIUM CARBONATE PRODUCTION						
92	P41	DISTILLATION						
		END TEST RESULT						

VALIDATION: The above training has / has not* been completed to the specified success criteria.

Signed:…….. *Print*: ……
(Training Officer)

Signed …… Print…….
(Trainee)

***Additional Training Officer Comments/Reasons for training incomplete**

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Maintenance Standards

S1-3 (9) Describe common risks and control measures - achieved doing practical activities, PTW, 3Whats
S1-3 (23) Understand the internal regulations pertinent to the employer & relative specialism in which they operate - achieved during site visits
S1-3 (24) Understand the external regulatory environment pertinent to the employer & relative specialism in which they operate (eg. COMAH, NII, MHRA) - achieved during site visits
S1-3 (25) Demonstrate compliance with internal and external regulations pertinent to the employer & relative specialism in which they operate - achieved during site visits
S1-3 (26) Work reliably and effectively without close supervision, to the appropriate codes of practice - achieved during all carousels
S4 (27) Demonstration of one or more problem solving techniques- achieved by Brainstorming - The group amasses all the relevant ideas about a situation and then attempts pick solutions that look the most promising, Root cause analysis – This is where we chase the way a problem presents itself all the way back to an initial, usually out of specification situation that was the primary cause of the problem and Means-ends analysis – This is where we choose and implement the most appropriate action at each step, as we move closer to our final goal.
S5 (30) Demonstrate the application of principles of continuous improvement to own performance - achieved during all carousels, reviews and 12 week reviews
S5 (31) Participate in improving systems and processes within your work environment or demonstrate where you have personally improved and become more efficient - achieved during all carousels, job freezes, reviews and 12 week reviews
S6 (32-33) Understand the business environment in which the company operates including personal role within the organisation, ethical practice and codes of conduct - achieved during site visits
S12 (48) Restore the work areas to a safe condition in accordance with agreed requirements and schedules- achieved during end of day closure procedure
S13 (51) Understand permit to work systems and demonstrate compliance with local system - - achieved using PTW during all carousels
S16 (55) Use appropriate documentation in planned maintenance activities - achieved during all carousels
S16 (58) Basic knowledge of relevant software packages e.g. MS WORD, EXCEL, LIMS (lab Info Mgt System), where appropriate to role is demonstrated- achieved throughout as applicable
S17 (59) Understand and apply technical knowledge relevant to a single specialist discipline or a number of disciplines (mechanical, electrical, instrumentation) as required by the job role - achieved during carousels, site visits, reviews
S19 Demonstrate the required attitudes, behaviours and interpersonal skills associated with the professional workplace - achieved throughout the carousel

Manufacturing Standards

S4-6 (27) Describe common risks and control measures - achieved during carousels, PTW, 3 Whats
S4-6 (39) Understand the internal regulations pertinent to the employer & relative specialism in which they operate- achieved during site visits
S4-6 (40) Understand the external regulatory environment pertinent to the employer & relative specialism in which they operate (eg. COMAH, NII, MHRA) - achieved during site visits
S4-6 (41) Demonstrate compliance with internal and external regulations pertinent to the employer & relative specialism in which they operate - achieved during site visits
S7 (44) Demonstration of one or more problem solving techniques - achieved by (Brainstorming - The group amasses all the relevant ideas about a situation and then attempts pick solutions that look the most promising, Root cause analysis – This is where we chase the way a problem presents itself all the way back to an initial, usually out of specification situation that was the primary cause of the problem and Means-ends analysis – This is where we choose and implement the most appropriate action at each step, as we move closer to our final goal.
S9 (47&48) Understand the business environment in which the company operates including personal role within the organisation, ethical practice and codes of conduct - achieved during site visits
S10 (49-51) Participate in continuous performance improvement- achieved over all carousels
S10 (52) Basic knowledge of relevant software packages eg MS WORD, EXCEL, LIMS where appropriate to role - achieved during carousels as and when required
S12 Demonstrate the required attitudes, behaviours and interpersonal skills associated with the professional workplace - achieved throughout the carousel and during carousel and 12 week reviews

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For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

SECTION 2

ELECTRICAL

SATISFACTORY KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING ITEMS HAS BEEN DEMONSTRATED VIA OBSERVATION OF PRACTISE AND THE COMPLETION OF PRACTICAL AND WRITTEN ASSIGNMENTS AND TESTS.

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MODULE TITLE :	**WORKSHOP SAFETY (PROCEDURES & PRACTICE)**
MODULE No. :	E24
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of workshop safety with regards to tools, equipment, behaviour and practices in accordance with the current training objectives.

OBJECTIVE NO.	**SUCCESS CRITERIA**
	The trainee is able to demonstrate knowledge and understanding of:
1	• maintaining safety of self by ensuring: a) overalls are a suitable fit and are securely fastened to chest level b) overalls sleeves are rolled down and cuffs are in good condition c) overalls are clean / relatively free from contamination, e.g. grease d) boots are the correct fit and laces are appropriately tied e) jewellery is either removed or suitably covered before work commences f) any loose items are removed and, when applicable, any long hair is suitably protected g) gloves and eye protection are worn and are suitable for the task
2	• the importance of housekeeping before, during and after the task is completed
3	• awareness of the workshop environment and the associated hazards including : a) the presence of dangerous voltages b) protruding edges c) heavy and/or unbalanced loads d) the presence of rotating equipment and associated (live) controls e) potentially hot equipment f) contaminated PPE, equipment and tools g) hazardous substances, e.g. resins, adhesives, lubricants, etc)
4	• visual inspection of all tools and equipment prior to, and following, their use selecting the correct tool for the task
5	• the correct values and behaviours including: a) paying attention to the task and any instructions being given b) testing potentially live terminals with an approved voltage indicator c) keeping the work area and tools and equipment clean d) recognising potential hazards and act upon them e) maintaining personal hygiene f) recognising the impact of tiredness and/or stress g) awareness of the impact of their behaviour on others

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**ELECTRICAL ISOLATION**
MODULE No. :	E25
SCOPE :	Develop trainee awareness, knowledge, understanding and practice of electrical isolation in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will, using Company procedures, be able to explain and demonstrate
1	• the Regulatory requirements for Electrical Isolation of equipment
2	• the purpose of the Permit to Work system with regard to the isolation of electrical equipment
3	• the safe isolation of single phase and 3-phase (400V) circuits with due regard to the Electricity At Work Regulations (1989)
4	• how to test and disconnect circuits up to 400V AC.
5	• how to test and re-connect circuits up to 400V AC
6	• the safe de-isolation of single phase and 3-phase (400V) circuits with due regard to the Electricity At Work Regulations (1989)
	Note : This unit can only be completed when all Phase I Electrical units have been completed

MODULE TITLE :	**ELECTRICAL EQUIPMENT – DISTRIBUTION AND PROTECTION**
MODULE No. :	E26
SCOPE :	Develop trainee awareness, knowledge and understanding of the equipment available for electrical distribution and the protection of circuits in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to explain, and demonstrate the purpose and application, of the following items:
1	• circuit protection, e.g. HRC fuse, MCB, RCD and rewireable fuse.
2	• earthing, e.g. electrodes, circuit protective conductors (CPC), earth cable, earth bonding and equipotential bonding.
3	• distribution switch gear, e.g. isolators, circuit breaker, distributor board, consumer unit, junction box, transformer and capacitor.

MODULE TITLE :	**TRANSFORMERS**
MODULE No. :	E27
SCOPE :	Develop trainee awareness, knowledge and understanding of the theory and principle of operation of transformers in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to
1	• explain the basic theory and operation
2	• primary and secondary windings
3	• demonstrate knowledge and understanding of :: a) step-up and step-down transformers b) current transformers c) auto / variable transformers d) safety transformers
4	• identify the primary and secondary windings by resistance checking
5	• calculate the number of coil turns required to achieve a specific output voltage
6	• identify the operational parts by dis-assembly and re-assembly, and fit a new secondary coil
7	• test the transformer using the following methods : a) insulation and continuity testing using suitable test equipment b) open-circuit (no-load) testing c) load checking

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**CABLES AND GLANDS**
MODULE No. :	E28
SCOPE :	Develop trainee awareness, knowledge and understanding of cables and glands in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to demonstrate:
1	• the correct selection, preparation, and fitting of suitable cable glands to the following types of cable : a) steel wire armoured (SWA) b) braided c) flexible cord
2	• how to resin joint two SWA cables including: a) preparation of the cables b) ensuring earth continuity c) selection and use of suitable crimp joints and insulation d) maintain suitable spacing between conductors e) how to mix and apply the compound
3	• how to test cables by selection and use of a suitable instrument and how to interpret the instrument readings
4	• How to identify and remove faults in equipment and control cables utilising the six point technique and fault location techniques for open circuits and short cuircuits such as a) Function Testing b) Unit Substitution c) Input to output d) Half-split technique e) Emergent problem sequence f) Equipment self diagnostics

MODULE TITLE :	**TRACE HEATING**
MODULE No. :	E29
SCOPE :	Develop trainee awareness, knowledge, understanding and practice of trace heating in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• describe the purpose and principles of trace heating in industry
2	• identify and explain the available methods of trace heating
3	• explain the purpose, principle of operation and the method of testing of a Residual Current Device (RCD)

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**BATTERIES**
MODULE No. :	E30
SCOPE :	Develop trainee awareness, knowledge and understanding of the construction and operation of batteries in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• identify secondary and primary cells and explain their differences
2	• describe the action of a secondary cell during charge and discharge
3	• determine the condition of a cell using a voltmeter, ammeter and load tester
4	• demonstrate the charging of a battery with the aid of a voltmeter and ammeter
5	• define series and parallel connections to obtain more current or voltage
6	• identify and explain all of the necessary safety precautions when working with batteries

MODULE TITLE :	**MOTORS**
MODULE No. :	E31
SCOPE :	Develop trainee awareness, knowledge and understanding of single-phase and 3-phase ac motor theory, operation and maintenance in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to:
1	• dis-assemble a 3-phase ac induction motor to it's component parts and explain the function of each
2	• identify and explain the motor maintenance requirements, to include correct lifting and slinging techniques.
3	• identify external indications of potential breakdown e.g. heat, smell, noise and vibration.
4	• explain the effect of connecting the motor windings in Star or Delta, with reference to starting and running current and torque
5	
6	• explain how some motor windings may be connected to operate at "dual voltage"
7.	• explain the principles of how the rotation direction of a motor may be reversed
8	• Identify the motor identification plate and explain the relevance of the information found on it
9	• re-assemble the motor and demonstrate knowledge of rotor clearance and shaft, bearing, and end-cover alignment.
	Note : This unit can only be completed when all Phase I Electrical units have been completed

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**MOTOR CONTROL**
MODULE No. :	E32
SCOPE :	Develop trainee awareness, knowledge and understanding of single-phase and 3-phase ac motor control theory and operation in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• state and demonstrate the electrical isolation procedure for a motor and the associated control circuit
2	• describe and demonstrate the methods used to ensure safe working practice including “testing for dead” at the appropriate terminals
3	• identify the main component parts of the control circuit and describe their principle of operation including a) contactor b) overload c) current transformers (where applicable) d) thermistor
4	• demonstrate how the main component parts may be tested, and explain how replacement parts may be obtained if required
5	• demonstrate selection of test-equipment and the necessary testing and fault-finding techniques
6	• using drawings, connect up the following types of motor control (inc. a connection to a Remote Control Unit and one (or more) Emergency Stop pus-buttons), and connect to a motor : a) direct-on-line (DoL) b) direct-on-line with auxiliary controls e.g. hand-off-auto switch, timer, pressure switch c) forward reverse d) star-delta e) variable speed f) direct-on-line with thermistor protection g) simulated three motor converyors system
7	
8	• select fuses with regard to the motor Full Load Current (FLC) information on the manufacturers plate • explain and demonstrate the de-isolation procedure including identification of the correct circuit, de-isolation, and testing

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**ELECTRICAL DRAWINGS**
MODULE No. :	E33
SCOPE :	Develop trainee awareness, knowledge and understanding and practice of using and interpreting electrical drawings in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• explain the format, application and information found on the following types of drawings: a) wiring and schematic b) circuit c) ladder d) flowchart
2	• demonstrate the purpose of each type of drawing when installing or fault finding on electrical equipment

SECTION 3

INSTRUMENTS

SATISFACTORY KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING ITEMS HAS BEEN DEMONSTRATED VIA OBSERVATION OF PRACTISE AND THE COMPLETION OF PRACTICAL AND WRITTEN ASSIGNMENTS AND TESTS.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**INSTRUMENTATION SAFETY – WORKSHOP INDUCTION**
MODULE No.'s :	I1/ I13
SCOPE :	The Trainees' safety awareness, behaviour, and approach when working in an instrumentation workshop environment and with its associated equipment in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	Trainee's will receive an Induction to the Instrument Workshop following which they should be able to explain:
1	• the need for Personal Protective Equipment (PPE)
2	• the importance of Work based attitude and behavaviour, including time-keeping, punctuality, and entering and leaving the work area
3	• Fire Alarm procedures
4	• maintaining safety of self by ensuring : a) overalls are a suitable fit and are securely fastened to chest level b) overalls sleeves are rolled down and cuffs are in good condition c) overalls are clean / relatively free from contamination, e.g. grease d) boots are the correct fit and laces are appropriately tied e) jewellery is either removed or suitably covered before work commences f) loose items are removed and, if applicable, long hair is suitably protected g) gloves and eye protection are worn and are suitable for the task
5	• the importance of housekeeping before, during and after the task is completed
6	• awareness of the workshop environment and the associated hazards including : a) the presence of dangerous air pressures b) protruding edges c) heavy and/or unbalanced loads d) the presence of moving parts that have the potential to harm, e.g. valve gates e) the presence of electrically controlled equipment f) potentially hot equipment g) hazardous substances, e.g. resins, adhesives, lubricants, etc)
7	• selecting the correct tool for the task, and visual inspection of all tools and equipment prior to, and following, their use
8	• the correct workplace values and behaviours including : a) paying attention to the task and any instructions being given b) recognising potential hazards and act upon them c) maintaining personal hygiene d) recognising the impact of tiredness and/or stress e) awareness of the impact of their behaviour on others

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**INSTRUMENT EQUIPMENT/ SYSTEMS and DIAGRAMS**
MODULE No. :	I14
SCOPE :	Refresh previous practice and further develop the learners knowledge, understanding and experience of basic instrument maintenance procedures on a variety of instrument systems in accordance with current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The learner is able to:
1	• read a P&ID, and Instrument loop drawings for the purpose of commissioning, maintenance and fault finding
2	• identify the components through selection, construction and test of basic control loops for measurement and control of the following process variables :
3	a) flow.
4	b) level c) pressure d) temperature
5	
6	• demonstrate an understanding of instrument loop numbering methods • select and use a range of appropriate test equipment for Calibration/ Commissioning and testing measurement and Control loops • use instrument diagrams to help logical fault finding/ problem solving approach, to safely determine faults, and identify suitable remedy. • Identify potential issues associated to impulse piping, and the impact these may have on process readings

MODULE TITLE :	**PROCESS ANALYSERS (QUALITY MEASURING INSTRUMENTS – QMI)**
MODULE No. :	I15
SCOPE :	Develop learner awareness, knowledge, understanding of process analysis and experience of analytical instrumentation in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The learner will be able to:
1	• Understand basic requirements of a sampling system, and appropriate checks
2	• explain the meaning of pH and the scales used.
3	• demonstrate an understanding of how pH values are measured using the colourimetric method, i.e., litmus, universal indicator.
4	• recognise industrial type pH installations.
5	• explain the different types of electrodes used and the need for care during handling and storage.
6	• demonstrate knowledge of buffer solutions by using them to check an industrial pattern pH meter.
7	• explain the basic principles of chromatography, how it is used and the basic maintenance procedure.
8	• describe the basic principles, operation of, and applications for the following : a) oxygen analysers b) liquid conductivity analysers c) radiation absorption analysers d) hygrometry e) thermal conductivity analysers (katharometers)
9	• explain and demonstrate the need for a suitable sampling system, and Identify the common faults that may be associated with it
10	• define Density and Specific Gravity
11	• explain the use of the Hydrometer to measure Specific Gravity
12	• explain how temperature can effect density, and other variables such as pH and concentration
13	• demonstrate an understanding of the buoyancy method of density measurement
14	• demonstrate an understanding of the equipment used to measure density using a DP transmitter and double dip pipe
15	• explain the basic principles with regard to the radioactive method of measuring density
16	• carry out routine tests on a typical Process Analyser systems

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**HAZARDOUS AREA EQUIPMENT and PROTECTION METHODS**
MODULE No. :	I16
SCOPE :	Develop trainee awareness, knowledge and understanding of the designation of a hazardous area and the different levels of protection available for electrical and instrument equipment designed for use in hazardous areas in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to:
1	• Identify a range of legislations, that relate to use of electrical equipment in Hazardous areas ie: HSE, DSEAR, EPS, ATEX
2	• Awareness of limitations of using electrical equipment in Hazardous Areas
3	• demonstrate an understanding/ awareness of the following terms : A. flashpoint B. auto-ignition C. flammable mixture D. lower explosive limit (LEL) E. upper explosive limit (UEL) F. Gas Groups G. Temperature Classification , T1-T6 and T amb.
4	• explain the meaning of the term “Area Classification/Zones”, demonstrate understanding of different Areas and why specialised equipment is required within them
5	
6	• identify and explain the certification code found on all the pieces of equipment with reference to applications, limitations and compatibility with other items of hazardous area pieces of equipment
7	• demonstrate basic understanding of the functional principles of protection for equipment suitable for use in hazardous areas (ExIA, ExD, ExP etc).

MODULE TITLE :	**CONTROL and SHUTDOWN VALVES**
MODULE No. :	I17
SCOPE :	Develop trainee awareness, knowledge and understanding of the role of Control / Trip Valves in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• define the major component parts of a control valve, explain their basic function and demonstrate where control valves fit into a control loop
2	• recognise the following valve types and state their typical applications: A. Saunders/Diaphragm type B. Ball valve C. Butterfly or Baffle D. Globe/plug and seat valve
3	• identify various types of seal, including bellows and gland seal, and explain the applications of each
4	• examine various materials used and explain the importance of selecting the correct material
5	• awareness of the following fail safe modes and explain typical applications for each: A. fail closed B. fail open C. fail stay-put
6	• understand the purpose of, various types of valve positioner and define the following: A. reverse acting B. direct acting
7	• understand operation of/and identify various valve actuators, such as Single/ Double pistion and Diaphragm
8	• explain valve capacity/flow characteristics/sizing information, i.e., C.V.
9	• explain the principle of operation and typical applications for solenoid valves
10	• identify valves used in association with shutdown systems
11	• explain methods used by operators to prepare the plant for valve removal and refit i.e. bypassing
12	• correctly introduce ‘process’ bypass network, to enable a valve to be isolated for maintenance, to minimise the risk of process disturbance or shutdown
13	• demonstrate how to disconnect and reconnect a control valve for servicing in a safe and competent manner
14	• Remove/install/commission control valve(s) into a process line and connect up the air lines in the correct sequence and manner

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

15 16 17 18 19	• identify/demonstrate methods of process decontamination of a control valve, to enable safe maintenance • identify (from stripped down valve) potential causes of valve failure or poor performance, and were appropriate take action to correct. Ie: replacing seals/ grinding plug and seat etc • On the Training Plant, complete a stroke check on a control valve, noting correct operation and possible issues ie; poor travel, air fail • explain the term “Split Range”, and aware of application • demonstrate an awareness/understanding of Smart/Digital Valve Positioners (DVC’s)

MODULE TITLE :	**PROCESS CONTROL THEORY AND APPLICATIONS**
MODULE No. :	I18
SCOPE :	Develop learner awareness, knowledge, understanding and experience to complete basic maintenance on a number of controlling instruments and control systems in accordance with current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
1	The learner is able to: • understand the functional roles of the Process Operator using Process Control equipment and systems, and in conjunction with plant maintenance Technicians • define standard technology in accordance with British Standards. • state the objectives of a control system. • identify the elements of a control system and describe purpose of each element • explain, with the aid of a drawing if required, the characteristics of : • an open loop system • a closed loop system
2	• define the following: • desire value • set point value • measured or process variable • output signal
3 4	• explain, the need for the correct switching procedures involving bumpless transfer for the following : Manual to Automatic, Automatic to Manual
5	• explain the operating conditions when a control system is operating in : Hand Bypass Control, Manual Control and Automatic
6	• explain, and give examples of, Measurement Lag, Transfer Lag, Distance Velocity Lag, and how these impact on control.
7	• explain what is meant by/and the characteristics of Two Step/ or On/OFF control
8	• Demonstrate how ‘Feedback’ and ‘FeedForward’ are used in a control system
9	• explain proportional action and state examples where a proportional only controller could be used. Understand Proportional Band and Gain • explain the effects of Offset (and Integral Action) with particular regard to load changes.
10	• Explain the impacts of Derivative Control on the Rate of change of the system
11	Explain the need for, set up conguration, and application for RATIO, CASCADE and ADAPTIVE control modes, and how these can resolve more complex control issues

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**PROCESS CONTROLLERS in Practice**
MODULE No. :	I19
SCOPE :	Develop learner awareness, knowledge and understanding of the available modes of process control in order to complete basic maintenance on control systems in accordance with current training objectives. This module is completed alongside Process Control

OBJECTIVE No.	**SUCCESS CRITERIA**
	The learner is able to explain:
1	• Interrogate and access the control settings of a Typical Hardware controllers such as TCS and Moore 352
2	• Use an electronic controller and demonstrate methods to input, read and program and change PID data. Use this to tune the controller
3	• to investigate the effects of Proportional Gain, and the impact this has on Process Control.
4	• Introduce Integral and Derivative to a control system to see their effects
5	• Using a Hardware Controller, Tune a Single loop Control System to given spec' (within 2%)
6	• Using a Hardware Controllers, Tune a Multi loop Control System to given spec' (within 1%)
7	• Using a Hardware Controllers, Tune a Multi loop Control System with Cascade to given spec' (within 0.5%)
8	• Use the Training Plant DCS system to perform 'Control valve Stroke Checking'
9	• Start up, and Tune a Software Controller on the TTE Training plant, within given parameters using the DCS
10	• Start Up, Operate, Tune the Control Systems on the TTE Training plant, with given parameters using the DCS
11	Awareness of alternative Control systems ie PLC

MODULE TITLE :	**DISTRIBUTIVE CONTROL SYSTEMS (DCS)**
MODULE No. :	**I20**
SCOPE :	Develop learner awareness, knowledge, understanding and experience to complete basic maintenance on DCS control systems in accordance with current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The learner is able to:
1	• understand the basic architecture, design, and components of the DCS system, and recognise the component parts of a DCS system
2	• navigate around the screen and toolbars, state what information can be displayed
3	• interrogate basic historical information, using history and trending functions and demonstrate the value of this
4	• use faceplates in order to carry out maintenance
5	• display multiple faceplates
6	• complete routine scheduled maintenance using the DCS screen ie; for Analogue and Alarm type input
7	• Read information from the DCS screen, and use this to test and calibrate equipment, including stroke checking.
8	• Access trending functions to assist in fault finding
9	• Access, and use the AMS function
10	• Demonstate loop tuning on a live Plant, to achieve best performance operations

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**SHUTDOWN /'TRIP' / SAFETY SYSTEMS**
MODULE No. :	**I21**
SCOPE :	Develop trainee awareness, knowledge, understanding and experience to carry out basic maintenance and checks on emergency plant shutdown systems in accordance with current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	Across the companies associated with TTE, different companies have adopted different designs, configurations and test methods associated to trip systems. The objectives covered in this unit, are aimed to give a general understanding, and a not aimed at one particular company system. The trainee is able to:
1	• identify and explain the reasons for using emergency shutdown systems (ESD's) both morally and legally
2	• explain the following modes : a) standby b) automatic
3	• describe the general characteristics of a common alarm system, and can explain/ understand alarm colour/ priority levels the associated with the following : a) shutdown/trip b) trip/maintenance isolation c) pre-alarm
4	• explain the reason for manual reset action
5	• explain the procedure following an emergency shutdown of process
6	• complete shutdown checks on live plant, against set criteria, with due regard for safety of self and plant operation and in harmony with common site procedures (inc. Permit to Work)
7	• start up the TTE Training Plant following the Operational Startup procedure, taking into account the requirements to reset the Trip System to normal.
8	• can recognise and demonstrate basic understanding of functional logic diagrams related to trip systems
9	• describe the fundamental operation of a shutdown system, including FAILSAFE
10	• explain the reasons for the following: a) trip/ maintenance override b) understands differences in configuration of maintenance override systems, and the pro's and con's of the different designs
11	• recognise a loop containing a safeguard system from its numbering system
12	• can describe the operation of a shutdown system from the schematic diagram for the following: a range of input verse outputs options ie 1 – 3, 1-10 , 2 out of 3
13	• complete scheduled checks on a shutdown/Trip system following written trip check procedures

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**DIGITAL TECHNOLOGY (HART/Fieldbus Instrumentation)**
MODULE No. :	**I22**
SCOPE :	Develop learner awareness, knowledge, understanding of how Digital technologies have developed and been applied within instrumentation systems, in accordance with current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The learner is able to:
1	• demonstrate a basic understanding of HART communication system
2	• demonstrate a basic understanding of FIELDBUS 'networked systems'
3	• identify the components of a Fieldbus system vs a HART system
4	• briefly explain the benefits of using 'smart' and 'Fieldbus' communication verses standard 4-20mA systems.
5	• Introduce/ Hook-up , and use a 'SMART' communicator to access 'set up' information from a range of transmitters (bench and online)
6	• Use a 'SMART' communicator to perform basic maintenance tasks on a SMART transmitter control loop, including re-ranging and loop testing
7	• Describe how digital technologies can be used in 'predictive maintenance'.
8	• Able to identify Fieldbus and HART device(s), from their markings
9	• Awareness of Wireless, and Bluetooth enabled communication systems
10	• Use the AMS feature to access and record device details
11	• Awareness of how Fieldbus devices are introduced to the network (steps taken), and issues that can be encountered.
12	• Use the Trex Communicator to access data from fieldbus devices

MODULE TITLE :	**PLANT MAINTENANCE**
MODULE No. :	**I23**
SCOPE :	From an E&I Technicians perspective develop trainee awareness, knowledge, understanding and experience to working on a Live Plant , and communicate effectively as would an instrument technician on site, in accordance with current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The learner is able to:
1	• Carry out a range of tasks, typical of an 'Instrumentation Technician' on Site. Working within Plant Operating Procedures and Practice. Liase with Pthe Process Team, and Following relevant Safety Standards, and Practices and within a Permit to Work System
	• understand the impact that maintenance tasks may have on Process Operations
	• Select appropriate tools and equipment, required to complete specified maintenance activities safely, creating minimal disturbance to the Plant.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

SECTION 4

MECHANICAL

SATISFACTORY KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING ITEMS HAS BEEN DEMONSTRATED VIA OBSERVATION OF PRACTISE AND THE COMPLETION OF PRACTICAL AND WRITTEN ASSIGNMENTS AND TESTS.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**WORKSHOP SAFETY (PROCEDURES & PRACTICE)**
MODULE No. :	ME1
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of workshop safety with regards to tools, equipment, behaviour and practices in accordance with the current training objectives.

OBJECTIVE NO.	**SUCCESS CRITERIA**
	The trainee is able to demonstrate knowledge and understanding of :
1	• maintaining safety of self by ensuring: 1) overalls are a suitable fit and are securely fastened to chest level 2) overalls sleeves are rolled down and cuffs are in good condition 3) overalls are clean / relatively free from contamination, e.g. grease 4) boots are the correct fit and laces are appropriately tied 5) jewellery is either removed or suitably covered before work commences 6) any loose items are removed and, when applicable, any long hair is suitably protected 7) gloves and eye protection are worn and are suitable for the task
2	• the importance of housekeeping before, during and after the task is completed
3	• awareness of the workshop environment and the associated hazards including : 1) the presence of overhead cranes and/or moving loads 2) protruding edges 3) heavy and/or unbalanced loads 4) rotating equipment (inc. electrical drills, grinders etc.) 5) obstructions in the walkways or work areas 6) contaminated PPE, equipment and tools 7) hazardous substances, e.g. cutting fluids, lubricants, anti-seize etc)
4	• visual inspection of all tools and equipment prior to, and following, their use
5	• selecting the correct tool for the task
6	• use of spill trays to prevent floor contamination when breaking open or draining equipment
7	• the correct values and behaviours including: (1) paying attention to the task and any instructions being given (2) keeping the work area and tools and equipment clean (3) recognising potential hazards and act upon them (4) maintaining personal hygiene (5) recognising the impact of tiredness and/or stress (6) awareness of the impact of their behaviour on others

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**JOINTS (MATERIALS AND COMPOUNDS)**
MODULE No. :	ME2
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of jointing materials and compounds in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to:
1	• identify the following types of flanges: a) slip on b) screwed c) weld neck d) socket weld e) van-stone lapped
2	• describe the reasons for using the following types of flanges: a) flat faced b) raised face c) gramophone finish
3	• compare and identify flange surface finishes a) by comparison gauge b) select surface finish for non-CF gaskets (e.g. spiral wound)
4	• demonstrate the use of flange tables by completing the following: a) measure the pitch circle diameter (PCD) of each flange used in Part 1 b) explain why the PCD is important when matching flanges c) measure the bolt hole sizes of each flange d) identify the number of holes in each flange e) identify whether the flange face is flat or raised f) identify each flange from Part 1 by comparing the information in Part 4 to the flange tables and stating the flange size and rating
5	• identify and allocate a variety of joints into the following appropriate groups: a) non-metallic joints b) semi-metallic joints c) metallic joints
6	• recognise a crushed asbestos joint (CF) and how to dispose of it correctly

MODULE TITLE : **JOINTING MATERIALS AND COMPOUNDS** *(cont'd)*

MODULE No. : ME2

OBJECTIVE No.	SUCCESS CRITERIA
7	• Demonstrate understanding of the methodology of gasket manufacture
8	• demonstrate knowledge and understanding of various jointing materials in relationship to various pipe-line specifications
9	• demonstrate an understanding of the construction of spiral wound gasket by: a) identifying the windings and fillers b) identifying the flange rating c) explaining the function of the inner and outer rings d) demonstrating the method of installing a spiral wound gasket to manufacturer's instructions
10	• demonstrate knowledge and understanding of the application of metallic gaskets by: a) comparing the performance of non-CF joint rings to metallic joint rings b) stating three applications for metallic gaskets where other gaskets would be unsuitable
11	• demonstrate a knowledge of compounds by: a) listing the compounds available to the companies b) describing a typical use for each one c) identifying any hazards that may be encountered when using three compounds
12	• identify and select the following compression fittings: a) generic compression fittings b) screwed union with flat gasket c) screwed union with tapered seat d) copper piping compression fitting
13	• demonstrate understanding and knowledge of pipeline maintenance methods including: a) unbolt all flanges on the training unit in a safe manner b) identification of any faults c) rebuilding the pipeline to specifications d) hydraulically testing the system e) handing over and receiving partially completed pipework to another maintenance team for completion

MODULE TITLE :	**VALVES**
MODULE No. :	ME3
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of the construction, installation and maintenance of valves in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• Describe the differences between various valve types and their specific applications for use, advantages and disadvantages.
2	• isolate, maintain and re-commission an example of the following valve types; plug, globe, gate, diaphragm or ball valves using the following method: a) identify and record a method of isolation b) check with Training Officer if the valve is safe to isolate c) isolate the valve in accordance with general safety procedures d) remove the valve from the pipeline in a safe manner using correct working practices and procedures e) dis-assemble each valve and identify the main components and common faults as outlined in the specifications f) demonstrate the direction of flow and describe the open and closing operation for each valve g) can re-install the valve into the pipeline using a safe method of work and the correct working procedures h) re-commission the valve and system to Company standards
3	• demonstrate an awareness of the economics of the decision making process for replacement or repair by: a) using existing company systems, obtaining price quotations for complete valves or component parts b) comparing the price of a new valve against replacement parts and time c) making a calculated decision on the most economical course of action

MODULE TITLE :	**PUMPS AND PUMPING**
MODULE No. :	ME5
SCOPE :	Develop trainee awareness, knowledge and understanding of pumps and pumping theory in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• demonstrate knowledge and understanding of the basic working principles of all types of positive displacement (PD) pumps by : a) explaining the effects increased pump speed on flow b) explaining the effects of pumping against a closed valve. c) describe two methods of preventing the product from passing back to the suction line
2	• compare positive displacement pumps with centrifugal pumps, identify and explain the following: a) the action of the fluid passing through the pump b) flow and speed ratio c) the handling of fluids with wide viscosity's d) causes of vibration, water hammer and noise
3	• demonstrate knowledge and understanding of the various types of rotary positive displacement (PD) pumps including: a) screw type b) gear type (internal and external) c) lobe type (2/3/4) d) vane type e) rotary piston type f) diaphragm pumps g) peristaltic pumps.
4	• demonstrate knowledge and understanding of the volumetric pumps by : a) describing their pumping principles b) describing the components and materials and give reasons for using them c) explain the requirement for priming these pumps prior to starting and the safety implications of not doing so d) explain, with the aid of drawings, the drive and sealing arrangements of both types of pump e) describe their advantages and disadvantages f) dis-assembling and re-assembling various types
5	• using available resources, research information and produce a PowerPoint presentation about volumetric pumps and present to the group and the instructor

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE : **PUMPS AND PUMPING** *(cont'd)* MODULE No. : ME5	
OBJECTIVE NO.	**SUCCESS CRITERIA**
	The trainee will be able to :
6	• demonstrate knowledge and understanding of the basic working principles of centrifugal pumps by: a) state the three functions of a centrifugal pump b) state what centrifugal force is and how it is applied to a pump c) demonstrate an understanding of the terms 'single stage', 'multi-stage', 'vertical' and horizontal' when applied to pumps d) identify types of impeller e) demonstrate an understanding of pumping problems, e.g. internal leakage, axial thrust
7	• identify, and understand the operational principles of the following: a) volute case b) pump-head c) bearing housing d) impeller
8	• state how flow and pressure are increased using the centrifugal pumps, and understand the terms ▲P and ▲H
9	• re-assemble an example of a centrifugal pump to include the following: a) identification of type and fit of bearings b) re-fitting the bearing housing assembly c) inspection and assembly of the mechanical seal d) determine the impeller running position and fit accordingly e) handing over and receiving partially completed pumps to another maintenance team for completion
10	• explain the principle and purpose of the following: a) concentricity b) water jackets

MODULE TITLE :	**ALIGNMENT METHODS AND PRACTICE**
MODULE No. :	ME8
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of alignment methods and the alignment of motors, pumps and compressors in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• explain and demonstrate the basic knowledge and understanding of shaft alignment by the following methods : a) straight edge b) dial test indicator c) laser d) pulley
2	• identify and correct faults, including soft foot, by setting up dial clocks to identify : a) angular in elevation b) parallel in elevation c) angular in plan d) parallel in plan
3	• record all readings to demonstrate correct axial alignment
4	• demonstrate knowledge and understanding of multi-functional laser alignment equipment by: a) setting up Laser Alignment equipment on a pump and motor in the correct manner b) aligning the pump and motor shafts to within ± 0.002”
5	• align pulley drives to company standards and procedures

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**RECIPROCATING COMPRESSORS**
MODULE No. :	ME9
SCOPE :	Develop trainee awareness, knowledge and understanding of reciprocating compressors in accordance with the current training objectives.

OBJECTIVE NO.	SUCCESS CRITERIA
	The trainee will be able to:
1	• demonstrate an understanding of the basic compression cycle
2	• demonstrate an understanding of the basic cylinder arrangements
3	• demonstrate an understanding of the following terms : a) single acting b) double acting c) single stage d) twin stage
4	• identify the different types of valves
5	• identify the methods of sealing the piston rods
6	• de-assemble and re-assemble various type of compressor

MODULE TITLE :	**CENTRIFUGAL COMPRESSORS**
MODULE No. :	ME10
SCOPE :	Develop trainee awareness, knowledge, understanding of a centrifugal compressors in accordance with the current training objectives.

OBJECTIVE NO.	SUCCESS CRITERIA
	The trainee will be able to:
1	• identify and describe the basic construction and operation of a centrifugal compressor
2	• identify all of the major components
3	• describe how the stages are sealed
4	• explain how the axial thrust is controlled

MODULE TITLE :	**ROTARY COMPRESSORS**
MODULE No. :	ME11
SCOPE :	Develop trainee awareness, knowledge, understanding of rotary and centrifugal compressors in accordance with the current training objectives.

OBJECTIVE NO.	SUCCESS CRITERIA
	The trainee will be able to:
1	• identify the following types of rotary compressor : a) Sliding Vane b) Liquid Ring c) Lobe d) Screw Compressor
2	• describe the principal of operation of each type
3	• describe the methods used to seal the shafts on each type
4	• describe the uses associated with each type

MODULE TITLE :	**BEARINGS AND BUSHES**
MODULE No. :	ME12
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of bearings and bushes in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to:
1	• demonstrate knowledge and understanding of bearings by explaining : a) the need for using bearings on rotating equipment b) rolling and sliding friction c) fluid friction d) (with the aid of a sketch), radial and axial loads e) the selection and identification of the type of bearing subjected to sliding and rolling friction
2	• identify, select and maintain sliding surface bearings and bushes by : a) identifying and selecting a one piece and split plain journal bearings b) identifying one application for each c) explaining why bearings have grooves cut into their boxes d) Identifying and selecting a babbitted journal bearing. e) identifying four materials of construction of plain bearings f) identifying and describing the six characteristics which combine to give a good running life to plain bearings
3	• identify, select and maintain sliding surface thrust bearings

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**LUBRICATION (FLUIDS AND METHODS)**
MODULE No. :	ME13
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of lubrication fluids and methods in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee is able to:
1	• explain the following three fundamental requirements of lubrication: a) to cool b) to minimise friction c) to prevent corrosion.
2	• describe the various applications of oils and grease: a) as a coolant b) in hydraulics c) an anti-seize
3	• with regard to design considerations, identify various modes of lubrication and explain the reasons for their selection taking into consideration: a) the accessibility of the moving parts b) the loads imposed. c) the speed of the rotating part.
4	• describe the following lubrication methods: a) oil bath (worm wheel and shaft in gearbox) b) splash lubrication (crankshaft in sump) c) re-circulatory systems (forced lub. systems, gear/piston pps) d) ring, chain and collar feeds e) wick feeds and lubrication pads f) drip feeds g) oil mist h) grease cups i) screw operated grease cups j) grease guns k) self-contained lubrication (grease packing)
5	• demonstrate knowledge and understanding of the importance of the correct selection of lubricant by considering the type of equipment to be lubricated

MODULE TITLE :	**LUBRICATION (FLUIDS AND METHODS)**
MODULE No. :	ME13 (continued)
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of lubrication fluids and methods in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
6	• identify a variety of oils and greases with reference to the type of machinery in which it is to be used: a) light oils (spindle bearings) b) medium oils (engines, crankshaft bearings and other stressed moving parts) c) heavy oil (for crank cases, gearings and other equipment used in power transmission systems) d) graphite grease (for glands) e) non-graphite grease
7	• demonstrate knowledge and understanding of maintenance schedules including a) their importance with relation to the life of the lubricants b) consulting relative charts and schedules in order to ascertain replacement of oils in machinery c) explain routine lubrication requirements
8	• explain the effects of over-packing with grease in relation to: a) bearings (over-heating and churning) b) glands
9	• discuss lubrication and technical problems with a supervisor and select the correct lubricant, and identify a suitable alternative, for specific plant and machinery items by using the relative charts and data sheets.

MODULE TITLE :	**MECHANICAL GLANDS & SEALS**
MODULE No. :	ME14
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of mechanical glands in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• recognise the need for using packed glands or mechanical seals on mechanical equipment.
2 3	• identify three types of equipment which requires a seal or packed gland
4	• explain why seals and glands are used
5	• describe, using simple drawings, the difference between the two forms of shaft sealing arrangements
6	• explain why mechanical seals would be the preferred option for a highly toxic or flammable duty
7	• demonstrate knowledge of the techniques and materials used in maintaining soft packed glands • explain the reason why, when installed and in use, there is a limited, or controlled, leakage through the seal
8	• demonstrate knowledge of the basic principles of mechanical seals by: a) identification and selection of rotating faces and stationary seals b) demonstrate, using a drawing, the primary sealing point and liquid film c) explaining the reason for the liquid film d) explaining how the flatness of the faces is measured e) demonstrating, using a drawing, the opening and closing pressures affecting a mechanical seal f) explaining the effects of both excessive and inadequate closing pressures g) identifying, with the aid of a diagram, the primary, secondary and the tertiary sealing points h) disassembling a standard rotating unit and seal and identifying the six primary elements
9	• distinguish between balanced and unbalanced seals by: a) identifying balanced and unbalanced seals by sight b) explaining, with the aid of a drawing, how the face pressure is reduced on balanced seals c) describing one application for each type

MODULE TITLE :	**MECHANICAL GLANDS & SEALS**
MODULE No. :	ME14 (continued)
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of mechanical glands in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
. 10	• identify, select and replace standard mechanical seals by : a) identifying and selecting four common type mechanical seals b) explaining why single spring seals are occasionally selected in preference to multi-spring seals c) describe one application for each type of seal d) removing a standard mechanical seal from a centrifugal pump e) identifying and selecting the correct replacement seal f) re-fitting the seal to the correct working length as specified by the manufacturers (e.g. Crane Seals Ltd.)
11	• demonstrate knowledge of a variety of seals found in industry including: a) installation of a single seal, inside or outside the seal housing, and state advantages of the installation b) installation of a suitable sealant system
12	• demonstrate an understanding and recognition of cartridge seals
13	• differentiate between common mechanical seals and cartridge seals
14	• identify, using drawings and/or photographs, the following fault symptoms and explain the cause : a) vaporisation b) dry running c) abrasives d) shaft fretting e) spring failure f) misalignment g) sludge bonding.

MODULE TITLE :	**PRESSURE VESSELS**
MODULE No. :	ME15
SCOPE :	Develop trainee awareness, knowledge and understanding of pressure vessels in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• describe the four main types used in industry:
2	• explain the definition of a pressure vessel
3	• using a drawing, identify and label the following types of vessel: a) cylindrical b) conical c) elliptical d) rectangular
4	• provide an understanding of the Regulations concerning vessels and the importance of the written scheme of examination.

MODULE TITLE :	**RELIEF STREAMS**
MODULE No. :	ME16
SCOPE :	Develop trainee awareness, knowledge and understanding of relief streams in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• describe the equipment used in a pressure relief streams by defining the following terms : a) pressure relief stream. b) protective devices. c) safety valve. d) bursting disc.
2	• Identify and inspect relief valves by completing the following: a) identify all parts by correctly labelling sectioned drawings of (i) a safety valve (ii) a relief valve (iii) a safety relief valve b) complete a general inspection of the valve for indications of blockage in the inlet or outlet ends of the valve body before decontamination takes place. c) explain the working principles of both pressure and vacuum relief valves d) inspection of the components as drawn on a line diagram
3	• have an understanding of bursting discs by completing the following: a) Knowledge of methods of removal and inspection b) Examination of condition and fault diagnosis c) explain the possible consequences of fitting a bursting disc incorrectly
4	• describe the equipment used on relief streams including: a) the uses of vents, stating possible problems that may arise and points to look for when inspecting them b) methods of examining upstream and downstream pipeline for obstructions
5	• draw, with the help of a line diagram, a typical relief valve system

MODULE TITLE :	**HEAT EXCHANGERS**
MODULE No. :	ME17
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of dismantling and rebuilding tube, shell and plate heat exchangers in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• dismantle a tube and shell heat exchanger and maintain by: a) removing the end-cover of plate heat exchanger, inspecting joints and joint faces and explaining the importance of sequential tightening procedures b) obtaining the correct type and size of joints and o-rings, and refitting to company standards and procedures c) during the inspection assessment hand over to another maintenance team the channel box end or the floating head end for them to complete d) checking the integrity of the rebuild by pressure testing to 4.0 Bar
2	• inspect the manufacturers working plate on the heat exchanger and record all information
3	• demonstrate knowledge and understanding of how to assecc and determine the cause of mechanical failure

MODULE TITLE :	**MACHINE GUARDS AND GUARDING**
MODULE No. :	ME18
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of machine guards and guarding in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
1 2 3 4 5	The trainee is able to: • locate and explain the following definitions from BS 5304: a) machinery. g) safety devices b) hazard h) safe working practises c) risk i) interlock d) danger j) failure to danger e) safeguard k) failure to safety f) guard l) integrity • demonstrate and explain the principles of machinery safety by: a) identification of hazard b) elimination or reduction of hazards by design c) use of safeguards d) use of safe working practices • identify and explain, using drawings if required, how entanglement can be caused. • identify hazards and select the correct design for various equipment on site and compare • discuss examples of industrial injury , reduction in risk and safe working methodology • explain the use of safety devices including: a) mechanical trip devices. b) electro-sensitive safety systems c) pressure sensitive mat system d) electrical switches

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**CONDITION MONITORING**
MODULE No. :	ME19
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of condition monitoring of mechanical equipment in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• explain the requirement for condition monitoring by identifying its effect on : a) safety b) efficiency c) cost
2	• describe the application of the following non-destructive testing methods: a) magnetic particle inspection b) ultra sonic inspection c) radiographic
3	• describe the application of vibration monitoring by: a) identifying its uses b) explain the techniques used
4	• complete vibration testing on one (or more) pieces of rotating equipment and record the findings before and after aligning the pulley drives to company standards and procedures

MODULE TITLE :	**DIAGNOSTIC SKILLS**
MODULE No. :	ME20
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of condition monitoring of plant equipment in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• diagnose possible faults on centrifugal and positive displacement pumps from information obtained from a typical chemical plant log by explaining the reasons for the following : a) loss of pressure from a centrifugal pump b) centrifugal pump not maintaining sufficient head after its motor has been changed c) gradual loss of sealant from a sealant tank d) product recycling through the bypass on a metering pump e) vibration and noise, low delivery pressure and discharge of oil on a centrifugal pump f) replacement centrifugal pump not operating
2	• diagnose possible faults in general plant equipment from information obtained from a typical Plant Operations Log by explaining the reasons for: a) reactor product temperature falling - steam jacket is cold b) stock tank pressure gauge showing vacuum when discharge pump is started c) stock tank lagging bulging and in dangerous condition d) a drop in outlet pressure from the shell side of heat exchanger - bottom of the exchanger is cold

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

SECTION 5

PROCESS

SATISFACTORY KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING ITEMS HAS BEEN DEMONSTRATED VIA OBSERVATION OF PRACTISE AND THE COMPLETION OF PRACTICAL AND WRITTEN ASSIGNMENTS, TESTS, REPORTS AND PRESENTATIONS.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**INTRODUCTION TO PROCESS RIG OPERATIONS**
MODULE No. :	P17
SCOPE :	Develop trainee awareness, knowledge, understanding and experience of operating and maintaining a series of experimental process rigs in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	On each piece of equipment the trainee is required to complete the following activities:
1	• conduct a Risk Assessment of the operational processes and produce a "Three-Whats" document prior to commencing each experiment.
2	• implement the Permit to Work system, ensuring a Permit to Work is completed and signed each, every time the equipment is to be used. The document is to be available at all times during the entire operation and must be "Signed off" on completion of the work or at the end of the working day (which-ever is first).
3	• complete all pre-operational equipment checks and complete any associated and appropriate documentation
4	• follow the detailed start-up procedure and complete the Check List document throughout the process
5	• operate the equipment, observing and recording all designated readings and observing that the correct conditions are maintained at all times
6	• maintain an Operations Log throughout the period recording all relevant activities and events.
7	• shut-down the plant equipment on completion of the operation, logging each action as it is completed
8	• complete all necessary clearing of the work area to leave it in safe and tidy condition
9	• file all documents relating to the operation in the appropriate folder
10	• produce an operations report for the experiment which will involve answering a series of specific questions relating to hazards that might have arisen during the operation
11	• in relation to rig operations the trainee must also complete 4 question and answer booklets that assess their knowledge and understanding of the following : a) Emergency Procedures b) General Emergencies c) Handovers and documentation d) Teamwork

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**PERMIT TO WORK**
MODULE No. :	P18
SCOPE :	Record trainee knowledge and understanding of P.T.W

OBJECTIVE No.	SUCCESS CRITERIA
1 .	The trainee will be able to: • With regard to the PTW system, explain and demonstrate knowledge of Safe Systems of Work including the following. a) Understand the meaning of and the reasons for “A safe system of work” and what should be contained within it. b) Understand the meaning of and the reasons for the “PTW” system and what should be contained within it. c) Understand the terminology of the PTW system. d) Understand the application of PTW. e) Understand when and why a PTW is needed. f) Indicate the essential features of a successful PTW system. g) Understand the importance of Issuer-Acceptor dialogue. h) Understand what Permits to Work look like.(What basic information should a Permit /Certificate contain). i) Differentiate between different kinds of Permits/Certificates.

MODULE TITLE :	**LOCK OUT TAG OFF SYSTEM**
MODULE No. :	P19
SCOPE :	Record trainee knowledge and understanding of Lock out Tag off

OBJECTIVE No.	SUCCESS CRITERIA
1	The trainee will be able to: • Explain and demonstrate knowledge of the LOCK OUT TAG OFF system including the following. a) Understand the meaning /definition/purpose of LOTO. b) Understand the requirements of LOTO. c) Understand the procedures for LOTO d) Understand types of hazardous energies.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**HAZARDS OF NITROGEN IN INDUSTRY**
MODULE No. :	P20
SCOPE :	To enable the trainee to understand the properties,uses and hazards of working with Nitrogen in industry.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will learn of:
1	• Properties of Nitrogen.
2	• Uses and Hazards of Nitrogen
3	• Hazards of Open Manholes
4	• Hazards of Temporary Confined Spaces
5	• Hazards of Piping Under Nitrogen Purge
6	• Hazards of Confusing Nitrogen with Air
7	• Hazards of Trapped Pressure
8	• Hazards of Liquid Nitrogen
9	• Hazards of Explosimeter Use in Nitrogen Atmospheres
10	• General Advice and Safe Practices

MODULE TITLE :	**(CBT INTERACTIVE) BASIC GENERIC INTRODUCTION TO CONFINED SPACE.**
MODULE No. :	P21
SCOPE :	To enable the trainees to understand how to work safely within a confined space.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• Describe the characteristics of a confined space.
2	• Identify three classifications of a confined space.
3	• State the phases of pre-job planning
4	• Describe the steps for isolation for a confined space.
5	• State the different atmospheric conditions for a confined space.
6	• Describe the entry of the confined space precautions and ongoing monitoring.
7	• Identify the steps of confined space work completion.

MODULE TITLE :	**PREPARATION FOR MAINTENANCE**
MODULE No. :	P22
SCOPE :	To develop student awareness in the subject of Preparation for Maintenance in accordance with current training objectives by interactively preparing a production vessel for maintenance.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee has an appreciation of scheduled and breakdown maintenance.
1	• Has an appreciation of legal and generic site procedures.
2	• Checks work area is accessible.
3	• An appreciation of purging and cleaning the vessel.
4	• Identify all safety hazards
5	• Identify all relevant services.
6	• Develop a safe system of work.
7	• Identify all safety equipment required.
8	• Identify all PPE required.
9	• Identify all risks and hazards
10	• Identify permitry requirements with other departments eg:electrical,mechanical
11	• State isolations required.
	.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**DISTILLATION RECAP.** **BASIC TOWER OPERATIONS**
MODULE No. :	P23
SCOPE :	Re-enforce previously delivered process distillation training training enabling the trainee to develop a greater understanding of basic tower operation in line with current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will:
1 2 3 4 5 5 7	• Look more closely at the operation and control of tray/plate columns. • Methods of processing heat sensitive materials. • Re-enforce understanding, meaning and importance of the following as they apply to fractional distillation. • Reflux ratio • Column temperature gradient • Continuous distillation • Vacuum distillation • Steam distillation

MODULE TITLE :	**PRE-START,START UP ,OPERATION AND SHUTDOWN OF A TYPICAL,BASIC VACUUM DISTILLATION SYSTEM.**
MODULE No. :	P24
SCOPE :	To re-enforce previous process department distillation training focusing on the above module title,in line with current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• Briefly describe the binary distillation process.
2	• State the purpose of pre-start up checks.
3	• List pre-start up checks commonly made on a vacuum distillation system.
4	• Describe what takes place during the first stage of a distillation system start up procedure.
5	• Describe what takes place during the second stage of a distillation system start up procedure.
6	• Identify problems that can show up during the start up of a distillation system.
7	• Explain the role of the feed rate in maintaining column equilibrium.
8	• Identify problems that can occur when the feed rate is incorrect.
9	• Explain the role of re boiler operation in maintaining column equilibrium.
10	• Identify problems that can occur when the re boiler is operated incorrectly
11	• Explain what Reflux is.
12	• Describe what can happen if the amount of Reflux is not correct.
13	• Describe conditions that can lead to three operating problems: overloading,flooding and puking.
14	• Explain how flooding can be prevented or controlled.
15	• Describe some mechanical causes of overloading.
16	• Describe a typical short term shut down procedure.
17	• Describe a typical long term shut down procedure.
18	• Describe a typical emergency shutdown procedure.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**BINARY COLUMN DISTILLATION SIMULATOR**
MODULE No. :	P25
SCOPE :	From a Process Operator's perspective develop trainee knowledge, understanding and practise of plant operation of the Distillation column in accordance with the current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to determine:
1	• What the effect of adjusting the inlet flow rate has upon the flows & compositions around the distillation column.
2	• The effect of adjusting the reflux ratio has on the column.
3	• The effect of adjusting the re-boiler temperature.
4	• Start up the Distillation column from a cold start position up to a fully operational condition with optimum efficiency
5	• answer a series of questions on the operation and potential hazards that might have arisen during the course of the distillation process

MODULE TITLE :	**EVAPORATOR SIMULATOR.**
MODULE No. :	P26
SCOPE :	Develop trainee knowledge, understanding and practise to re-enforce previous process department evaporator training focusing on the above module title, in line with current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
1 2 3	The trainee will be able to determine: • The reduction in inlet flow rate set-points. • The effect of an increase in steam flow. • The efficiency of the evaporator & running conditions.

MODULE TITLE :	**PACKED COLUMN**
MODULE No. :	P27
SCOPE :	Develop trainee knowledge, understanding and practise for the operation of a Packed Column in accordance with the current training objectives..

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• investigate the relationship between gas flow rate and pressure drop across the packing, dry, wetted and irrigated.
2	• plot the relationship on logarithmic coordinates and, in the case of irrigated packing, identify the loading and flooding points.
3	• observe the flow pattern in the column both when fully loaded and then when flooded and explain why industrial columns should be operated between these conditions for optimum performance.
4	• complete an operational report on the running of the column.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**OPERATIONAL PLANT HANDOVER PROCEDURES**
MODULE No. :	P28
SCOPE :	Develop trainee knowledge, understanding and practise of the giving and receiving of a written and verbal information during a plant handover in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee is able to:
1	• complete a operational plant handover to a member of the following shift team. This will involve : a) ensuring all paperwork and permitry is available, legible, complete, and up to date b) giving a verbal report of the condition of the equipment, highlighting any problems and safety issues that are relevant c) asking questions to ensure that that operator is aware of, and has understood, all of the relevant information
2	• receive a operational plant handover from a member of the previous shift team. This will involve : a) checking all paperwork and permitry is available, legible, complete, and up to date b) checking that the plant conditions shown on the monitor match those recorded in the log c) highlight any discrepancies with the operator that is handing over d) ask relevant questions about the condition of the plant and/or process e) answer questions designed to check that the information presented has been understood
3	• walk around the plant at an early opportunity to be sure that all plant conditions are visually safe and is in accordance with the records received

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**HEAT EXCHANGER SIMULATOR**
MODULE No. :	P29
SCOPE :	Develop trainee knowledge, understanding and ability to operate the simulator and monitor and record data in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
1 2 3 4	The trainee will be able to determine: • the correct response to temperature set point changes • the effect of reducing the flow rate of process fluids • the effect of changing the surface area across the tubes • the effect of designing heat exchangers with different “U” Factors

MODULE TITLE :	**HEAT BALANCE CALCULATIONS**
MODULE No. :	P30
SCOPE :	Develop trainee knowledge and understanding of heat balance calculations in order to determine the efficiency of Double Effect Evaporator in accordance with the current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
1	The trainee will be able to: • complete a series of enthalpy calculations derived from the heat balances produced

MODULE TITLE :	**LEGIONELLA SAMPLING**
MODULE No. :	P31
SCOPE :	Develop trainee knowledge, understanding and practise of the sampling of cooling water tanks in accordance with the current training objectives.

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• take a sample of the cooling water from the supply tank
2	• measure the pH and conductivity of the water
3	• dip a slide coated with nutrient and a disclosing agent in the sample, label it and place it in an incubator, controlled at a temperature of 35˚ for 48 hours
4	• compare the bacterial and algae growth obtained after incubation with a standard chart
5	• record all results on the appropriate log and report any that fall outside the range of acceptable limits

MODULE TITLE :	**STAINLESS STEEL COLUMN**
MODULE No. :	P32
SCOPE :	Develop trainee knowledge, understanding and skills required for vessel entry and the removal and re-fitting of plates in the S.S. column in accordance with the current training objectives

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• prepare the column and isolate associated equipment for safe entry
2	• follow vessel entry procedures to gain access to the interior of the column and remove the existing plates
3	• replace plates with different type
4	• re-commission and de-isolate the column

MODULE TITLE :	**MANAGING AN OPERATIONAL PLANT**
MODULE No. :	P33
SCOPE :	Record trainee knowledge and understanding of operational plant procedures and practise by assessment of the completed written assignments

OBJECTIVE No.	**SUCCESS CRITERIA**
1	The trainee will be able to produce evidence on: a) Spillage procedures through discussion b) A general emergency – report must address the general questions regarding emergency procedures c) Teamwork d) Handovers and documentation
2	The trainee will have the opportunity to manage and control a live operational plant, and will provide evidence of: a) Plant start up and Shutdown. b) Bringing all areas of the plant online and to optimum performance or desired values c) Controlling and Managing the plant in response to daily demands d) Managing and controlling daily maintenance activity whilst controlling the plant e) Preparing the live plant for maintenance and return to normal afterwards, with minimal plant disruption. Ie; Trip Checking, Stroke checking, removal/ refit of valves, calibrations etc f) Complete plant daily operational logs g) Carry out daily and routine checks on a live plant h) Bring online/ Take offline Pumps, and Heat exchangers during live operation i) Transfer plant load from one vessel to another j) Respond to a plant emergency situation (simulated fire or pipe leak) k) Facilitate plant handover l) Facilitate issue of Permit To Work (overseen by TO) m) Take samples and perform basic analytical checks Perform basic condition monitoring operations

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**WORKING WITH CENTRIFUGAL PUMPS**
MODULE No. :	P34
SCOPE :	To re-enforce mechanical training, enable the process trainee to develop a greater understanding of centrifugal pump operation and associated auxillary systems within a process system, pre-start checks, pre-start up, monitoring methods and shutdown

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
1	• Describe the basic types and function of centrifugal pumps
2	• Explain the characteristics, advantages and disadvantages of centrifugal pumps
3	• Mechanical terminology recap of centrifugal pump parts
4	• Brief explanation of Net Positive Suction Head
5	• Explaination of cavitation, cavitation on start up and how to avoid/detect it
6	• Seal/flush systems, pressurised barrier fluid and maintenance of the system
7	• Duty and stand by pumps and the warming by-pass
8	• Starting up centrifugal pumps
9	• Pre-start checks
10	• Routine checks
11	• Shutdown

MODULE TITLE :	**WORKING WITH POSITIVE DISPLACEMENT PUMPS**
MODULE No. :	P35
SCOPE :	To re-enforce mechanical training to enable the trainee to develop a greater understanding of positive displacement (PD) pump operation and associated auxillary systems within a process system, pre-start checks, start-up and monitoring methods

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
1	• Describe the basic types and function of PD pumps
2	• Explain the characteristics, advantages and disadvantages of PD pumps
3	• Pre-start check
4	• Starting up pre-start checks
5	• Routine checks

MODULE TITLE :	**WORKING WITH STEAM TURBINES AS PRIME MOVERS**
MODULE No. :	P36
SCOPE :	Develop trainee awareness, knowledge and understanding of Steam Turbines in accordance with the current training objectives

OBJECTIVE No.	SUCCESS CRITERIA
	The trainee will be able to:
1	• Understand how steam is economically utilized
2	• Understand the basic principle of how steam turbines work
3	• How they are classified: a) Condensing b) Non-condensing c) Impulse d) Reaction
	• Know how multi stage steam turbines function
4	• Know their components and auxiliaries: a) Blading
5	b) Nozzles c) Seals/seal systems d) Bearing e) Governors f) Overspeed trip mechanism g) Sentinel/pressure relief valves h) The lubrication oil system
6	• Understand how steam turbine problems occur: a) Hunting b) Vibration
	•
7	• Gain an awareness of a) Hazards associated with steam and steam turbines b) Pre-start checks c) Warm up d) Dry out e) Start up f) Routine checks g) Shutdown

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**WORKING WITH INDUSTRIAL COMPRESSORS**
MODULE No. :	P37
SCOPE :	To re-enforce mechanical training, enabling the process trainee to develop a greater understanding of industrial compressors, centrifugal and reciprocating compressors, their operation and associated auxiliary systems within a process system, pre-start checks, start up and monitoring methods.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
1	• Work with industrial compressors, understanding: a. what a compressor is b. the basics of a compressor c. the classifications of compressor d. the compressor type selection e. the compressor capacity f. the compressor ratio g. the common characteristics
2	• Recap knowledge of TTE mechanical compressor training, understanding: a) The types of compressors b) Centrifugal compressor c) Radiall compressor d) Axial compressor e) Reciprocating compressor f) Rotary compressor (screw)
3	• Understand single stage versus multi stage compressors
4	• Understand surging, a) The facts. b) Surge control.
5	• Understand the basic functional parts and auxiliaries of a centrifugal process gas compressor: a) Power unit or driver b) The compressor c) The process piping system d) The recycle, pipe exhaustion bellows, silencers, snubbers e) The lubrication system f) Water cooling system
6	• Understand the seal system a) Dry gas seals b) Coolers c) Separators demisters, dessicant dryers d) Oil separators e) Suction filter
7	• Understand potential problems a) Over pressurization b) Over heating c) Surging d) Seal oil problems e) Leaks f) Lubrication fluid contamination g) Vibration

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**WORKING WITH INDUSTRIAL COMPRESSORS (cont)**
MODULE No. :	**P37**
SCOPE :	To re-enforce mechanical training, enabling the process trainee to develop a greater understanding of industrial compressors, centrifugal and reciprocating compressors, their operation and associated auxiliary systems within a process system, pre-start checks, start up and monitoring methods.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
8	• Understand Interlock Systems
9	• Understand Safety Valves
10	• Understand additional compressor terminology a) Unloaders/unloading b) Hydrocom control c) Manzel lubrication d) Barring the compressor
11	• Understand safety and environment hazards
12	• Understand centrifugal compressors a) Pre start checks b) Start up c) Routine checks d) Shutdown
13	• Understand reciprocating compressors a) Pre start checks b) Start up c) Routine checks d) Shutdown

MODULE TITLE :	**CENTRIFUGAL COMPRESSOR SIMULATOR.**
MODULE No. :	P38
SCOPE :	Develop trainee awareness, knowledge and understanding to re-enforce previous process department compressor training focusing on the above module title, in line with current training objectives.

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to determine:
1	• The correct responses to changes in pressure & temperature set-points.
2	• The purpose & operation of the recycle loop.
3	• The effect of temperature & pressure on the gas compositions.
4	• The different methods of flow control for a centrifugal compressor.

MODULE TITLE :	**PROCESS FURNACES**
MODULE No. :	P39
SCOPE :	To develop trainee awareness ,knowledge and understanding of Process Furnaces in accordance with current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will gain an introduction to:
1	• Furnace types and their uses.
2	• Types of fuel.
3	• Description of a furnace.
4	• Combustion a) Chemistry of combustion b) Heat losses in flue gas c) Net calorific value. d) Combustion of gaseous/liquid fuels.
5	• Primary and secondary air.
6	• Conduction/convection/radiation within a furnace. a) The circular radiant furnace. b) The SIPM vertical furnace.
7	• Control of excess air /incomplete combustion. a) Flame impingement / Coking b) Skin temperature.
8	• Draught. a) Natural/Forced/Balanced.
9	• The fuel system.
10	• Burners part 1 a) Function b) Parts c) Atomisation of liquid fuels. d) Pressure jet e) Steam jet/Steam atomisers f) Tips and Plugs
11	• Burners part 2. a) Position within a furnace b) Gas burners. c) Gas gun d) Central gas or dual fuel gun e) Gas ring burner f) Quarls g) Registers/Flame shape h) Flame stabilisation i) LMV burner. j) Low Nox burner k) Lyunet pressure jet burner.

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

MODULE TITLE :	**PROCESS FURNACES (continued)**
MODULE No. :	P39
SCOPE :	To develop trainee awareness ,knowledge and understanding of Process Furnaces in accordance with current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will gain an introduction to:
12	• Ignitors .
13	• Preparation .for start-up. a) TFIT -Trial for ignition time
14	• Routine checks.
15	• Support systems. b) Soot blowers c) Rotary and retractable d) Shot cleaning system. e) Chemical cleaning. f) Centrifugal fans (blowers). g) Flame arrestors h) Flame eyes
16	• Points to remember.
17	• Additional terminology.
18	• Environmental aspects/emissions.

MODULE TITLE :	**CALCIUM CARBONATE PRODUCTION**
MODULE No. :	P40
SCOPE :	To develop trainee knowledge, understanding and practice of operating plant production of Calcium Carbonate in accordance with current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
1	• Precipitate calcium carbonate by mixing solutions of sodium carbonate and calcium chloride in a stirred reaction vessel fitted with a steam heating coil by using the following method:. i. Prepare a plate and frame filter press to receive the precipitated calcium carbonate. ii. Transfer the contents of the reaction vessel to the filter using the positive displacement mono pump iii. Wash the filter cakes using the wash channels on the press iv. Recover, dry and weigh the filter cakes
2	• Write a balanced chemical equation for the reaction
3	• Calculate the theoretical yield of the chalk and compare this with that obtained
4	• Answer a series of questions in relation to the operation and hazards that might have occurred, giving a suitable course of action to eliminate and overcome them.

MODULE TITLE :	**DISTILLATION**
MODULE No. :	P41
SCOPE :	To develop trainee knowledge, understanding and practice of plant operation of the Distillation Column in accordance with current training objectives

OBJECTIVE No.	**SUCCESS CRITERIA**
	The trainee will be able to:
1	• Start-up and operate a continuous distillation column, 80mm in diameter comprising 9 bubble cap plates distilling a dilute solution of methanol in water.
2	• Set a specified feed rate and reflux ratio and observe and record the plate temperatures in the column as it comes to steady state conditions
3	• Shut-down the column safely at the end of the run.
4	• Answer a series of questions in relation to the operation and potential hazards that might have arisen, during the course of the distillation process. .

For mapping to the relevant apprenticeship standards please see the indivudal index pages 11-27

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