



SUNCOMBE
CIP & PROCESS ENGINEERS

Vessel Design

By

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Suncombe Ltd

Is it a Tank or a Vessel?

A Tank is defined as a large (usually metallic) vessel for holding gases or liquids at atmospheric pressure.

A vessel (or pressure vessel) is defined as a closed container designed to hold gases or liquids at a pressure different from the ambient pressure.



Mechanical Design

- Dimensions
- Liquid Specific Gravity
- Jacket Features
- Internal/External Design
- Pressure
- Max. Design Temp.
- Head Types
- Nozzle Requirements
- Materials of Construction
- Weld Finishes (Int/Ext)
- Electropolishing
- Agitator Specs.
- Support (Legs/Lugs/Casters)
- Load Cell Information
- Insulation Type
- Cladding type (304L/316L)
- Passivation

Pressure Design Codes

- Atmospheric Tanks designed to SEP/GMP
- Pressure Vessels designed to PD5500, ASME VIII, EN13445, CODAP etc

Materials of Construction

316L SS	Process for Biopharma, High Purity Water, Foods, Beverages, Corrosive Liquids.
304L SS	Process Waste, Utilities in Clean Areas, Corrosive Liqs
Hastelloy, Incoloy	Bulk Pharmaceutical Reactors/Receivers, Highly Corrosive Liquids

Surface Finishes

Surface Finish Comparison

Standard Grit	R _a	R _a	RMS	RMS
	μ-in	μm	μ-in	μm
150g	27-32	0.68-0.80	30-35	0.76-0.89
180g	18-23	0.46-0.58	20-25	0.51-0.64
240g	14-18	0.34-0.46	15-20	0.38-0.51
320g	8-10	0.21-0.25	9-11	0.23-0.28

Grit: Measures the number of scratches per linear inch of abrasive pad. Higher numbers indicate a smoother surface

RMS: defined as Root Mean Square roughness, this method measures a sample for peaks and valleys. Lower numbers indicate a smoother finish

Ra: Known as the arithmetic mean, this measurement represents the average of all peaks and valleys. Lower numbers indicate a smooth finish

ASME BPE Surface Finish

Surface Designation	Ra Max. μ-in.	Polishing μ-m	Criteria
SF0	No Finish Requirement		
SF1	20	0.51	Mechanical
SF2	25	0.64	Mechanical
SF3	30	0.76	Mechanical
SF4	15	0.38	Electro-Polished
SF5	20	0.51	Electro-Polished
SF6	25	0.64	Electro-Polished

Nozzles

- Inlets (dip tubes, weep holes, anti-foam, tangential)
- Outlets (bot center, side, valve/mounting, vortex breakers)
- Manways (circular, elliptical/oval, hinged, bolted, entire top head)
- Handholes (diameter, location)
- Sight/Light (individual/common port, 2 sights w/flashlight)
- Level (dp cells, point readings, capacitance probe, radar, ultrasonic)
- Pressure (diaphragm seal)
- Relief (burst disc, relief valve, combinations)
- Temperature (RTD, thermowell)
- Analytical Instruments (PH, conductivity)
- Vent (filter, atmospheric)
- Sample (sanitary, aseptic, sterile)
- Sprayballs (static, rotary, jet, location, number)
- Agitator (magnetic coupling, top-bottom-side, impellor types, baffles)
- Spares (inlets, handholes, probes, provide w/caps or plugs)

Mixers/Agitators/Homogenisers

Coupling

- Magnetic – no vessel intrusion
- Single or double seal – suitable for atmospheric or pressure use



Impellers

- Low Shear
- High Shear
- Powder Incorporation



Spray Devices – Fixed

Low Pressure – High Flow

Advantages





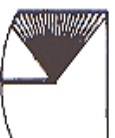
- No maintenance
- Special Spray Patterns
- Easier to Monitor
- Less Pump Power



Disadvantages

- Higher Water Usage
- Less Mechanical Action
- Less Bounce Back
- Longer cleaning times



	(A) 360° Spray Angle
	(B) 360° Top Intensive
	(C) 210° Spray Angle
	(D) 180° Spray Angle
	(E) 90° Horizontal Tanks

Spray Device – Rotating

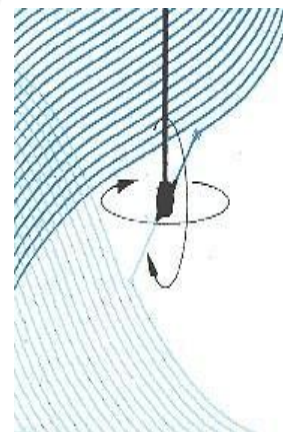
High Pressure – Low Flow

Advantages

- Lower Water Usage
- Greater Mechanical Action
- Greater Bounce Back
- Greater Throw Distances



‘Turbodisk’



Disadvantages

- Higher Pump Power
- More Difficult to Monitor
- Generally Higher Cost
- More Difficult to “Aim” Spray
- Higher Maintenance



Jets



Slotted



Jacket Types

Type	Features
Full Pressurised Spiral Flow	high flow, low pressure drop, more coverage, low U
Limpet Coil	high flow, low pressure drop, hard to fit, medium U, high Cost
Dimple	lower flow, high pressure drop, easier to fit, good U, low cost, hot/cold spot potential

Vessel Heads

- Hinged or Open Tops
- Flat Heads
- Sloped Flat bottoms
- Dished Heads
- Elliptical Heads
- Hemispherical Bottoms
- Conical Bottoms

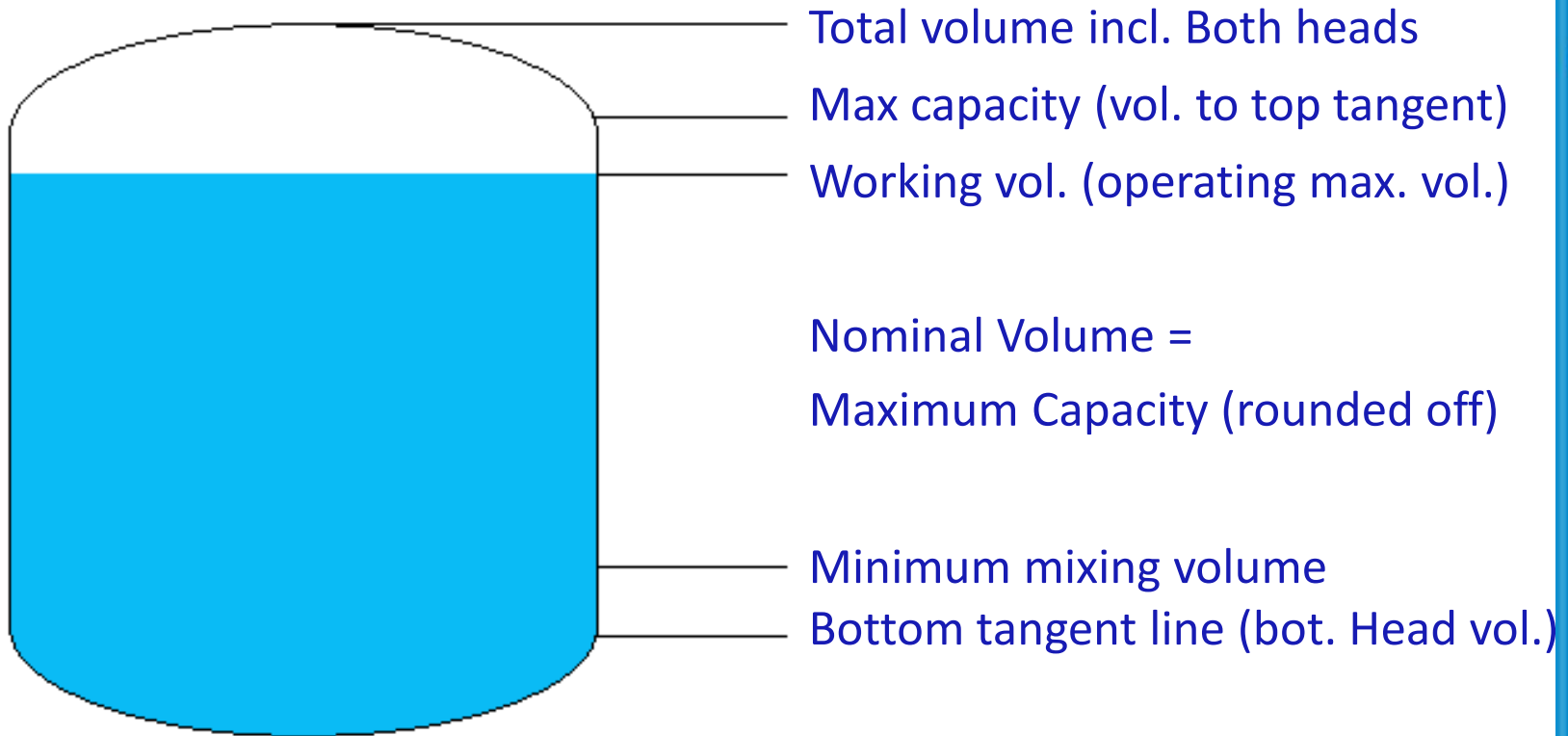


Vessel Geometries

- Vertical/Horizontal
- Diameters
- Tan to Tan heights
- Length/diameter ratio
- Mixing volume requirements
- Nozzle requirements
- Ergonomics
- Movement through door
- Portability



Volume Designation



Vessel Insulation

- Normally mineral wool
 - Typical insulation is at sides
 - Can extend around base
 - 25mm – 100mm thick
 - Asbestos and chloride free
 - Heat and cold conservation

Electropolishing

The electrochemical removal of a metal surface immersed in a suitable electrolyte by utilising a DC power source.

Removes surface contaminants and micro-softens the surface which produces an excellent passive surface that enhances the corrosion resistance.

Passivation

Passivity is the state at which a stainless steel exhibits a very low corrosion rate.

Passivation is the means of obtaining the electrochemical condition of passivity through stabilization of the passive layer.

Passivation solutions used are Nitric acid, Phosphoric acid and mixed Chelants.

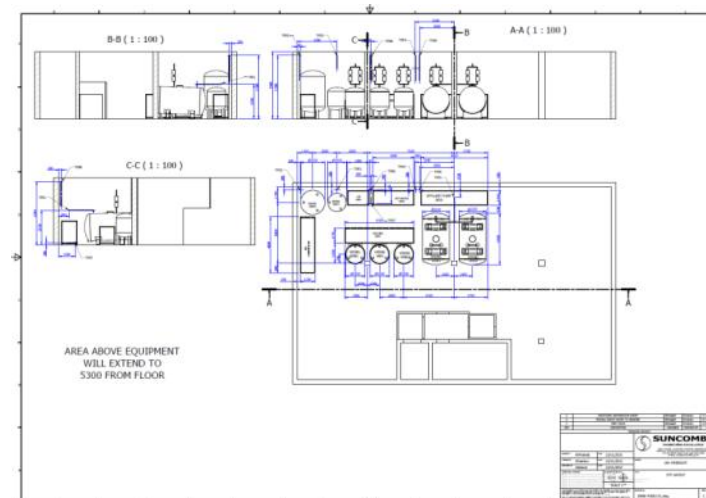
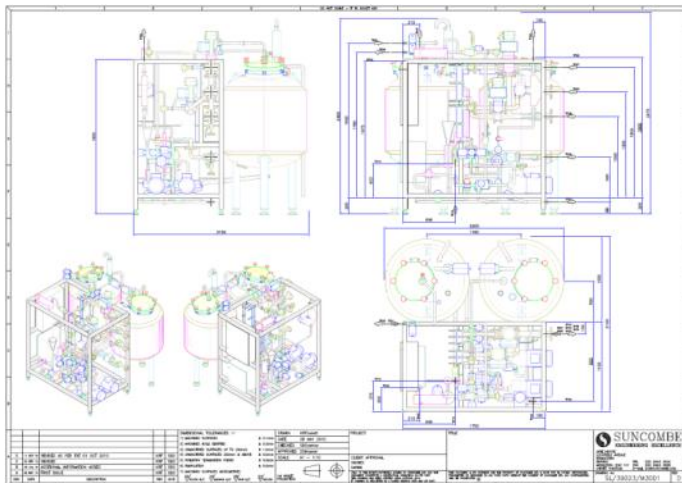
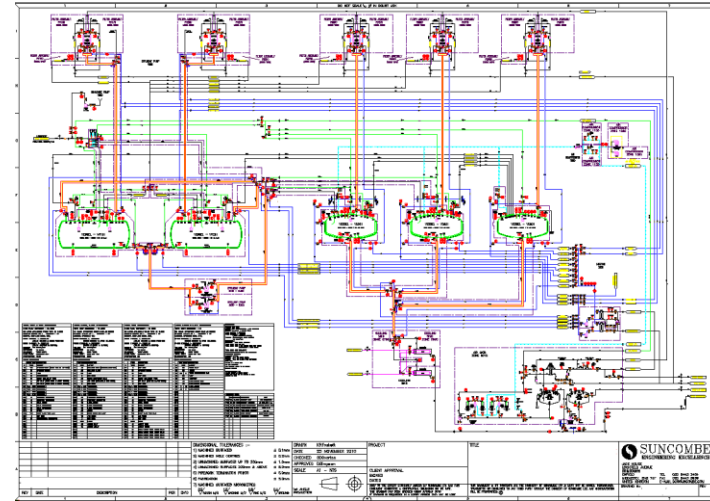
Cleanability

- Proper finishes
- Short Ferrules
- Angled Ferrules
- Large Ferrules
- Mounting Ferrules for Diptubes
- Number of Sprayballs
- Sprayball location
- Cleanable agitator
- No dead pockets
- Drainable

Our Design

Drawing

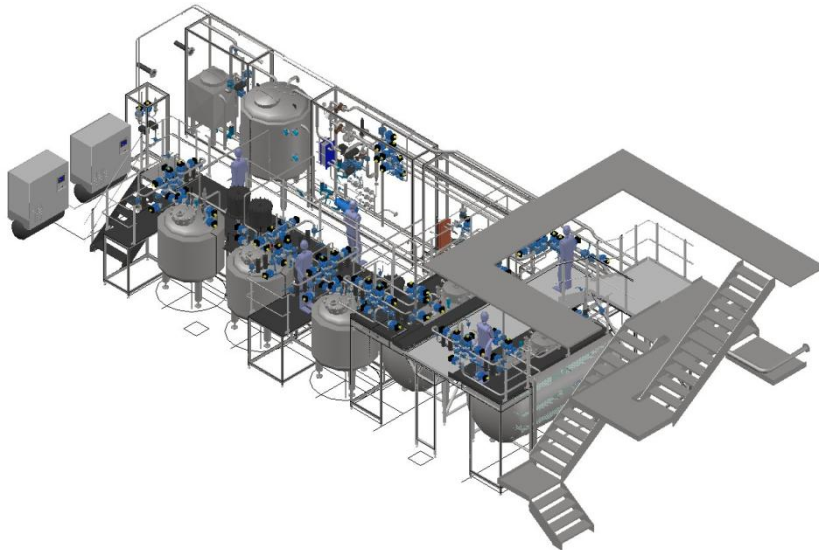
- PFD, P&ID, Schematics and Circuit Diagrams in ACAD



Our Design

3D Modelling

- Autodesk Inventor 3D Modelling is employed throughout the design process



Our Certification

Certification

- CE Mark – we design and manufacture pressure vessels and assemble pressure equipment and CE mark in accordance with Pressure Equipment Directive 97/23/EC
- We primarily design to PD5500, ASME VIII and EN 13445, with facilities for other codes. Self certification and third party certification are used, together with NDT Testing to code.



Our Hygiene Standards

Equipment Standard

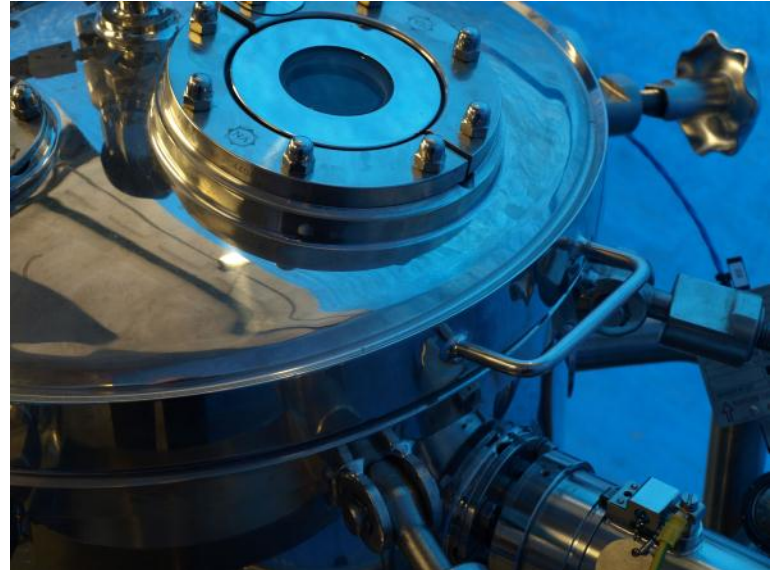
- 316L Stainless Steel, Duplex Stainless and Hastelloy materials
Surface RA 0.5um or better
- ASME BPE standard Pipework, fully annealed, chemistry to ASTM A-269, manufactured to ASTM A-270, and 3A Standard.
- Sanitary designed to ensure no deadlegs or product retention areas complying with ASME Bioprocessing Equipment guidelines.



Our Manufacturing


Welding

- Welding would be of T.I.G. (Tungsten Inert Gas) method; using an internal and external argon gas purge, using a computer controlled enclosed head orbital welding plant, carried out by technicians coded to EN 287, to Suncombe procedures to EN ISO 15609 (formerly EN 288 Part 2), tested to EN ISO 15614 Part 1 (formerly EN 288 Part 3). Welding profiles and maps will be compiled for all welds.
- 100% Boroscopic Inspection of all welds



Our Testing

- A Factory Acceptance Test (FAT) Protocol is compiled for all systems and is client witnessed.
- The FAT incorporates full documentation checks, wet and dry system testing and is carried out to ensure our clientele that our systems are fully functional prior to despatch.
- An FAT report accompanies the equipment and can be used as leverage for the site based Site Acceptance Testing (SAT).
- Suncombe personnel can carry out or assist in client Qualification activities.

FACTORY ACCEPTANCE TEST		PAGE 1 OF 36
 SUNCOMBE <small>ESTD 1988</small>	CLIENT:	
	PROJECT:	
	PO No:	
	JOB NO:	
	ISSUE:	
	STATUS:	

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Factory Acceptance Test Protocol

PROTOCOL APPROVAL					
Completion of the following signature blocks signifies the approver has read, understands, and agrees with the content of this document.					
Name	Job Title or Role	Signature	Date		
			DD	MMM	YY
The Suncombe Engineer is signing to confirm that they have reviewed the document.					
The Client Project Engineer is signing to confirm that the technical content is correct					
The Client Validation Engineer is signing to confirm that the protocol complies with company policies and local requirements.					

REPORT APPROVAL					
Completion of the following signature blocks signifies the system Factory Acceptance has been completed and documented; the equipment is accepted for delivery as fully compliant with discrepancies to be corrected (delete as appropriate)					
Name	Job Title or Role	Signature	Date		
			DD	MMM	YY
The Suncombe Engineer is signing to confirm acceptance of the summary report and supporting results.					
The Client Project Engineer is signing to confirm acceptance of the summary report and supporting results.					
The Client Validation Engineer is signing to confirm acceptance of the summary report and supporting results.					

Our Validation

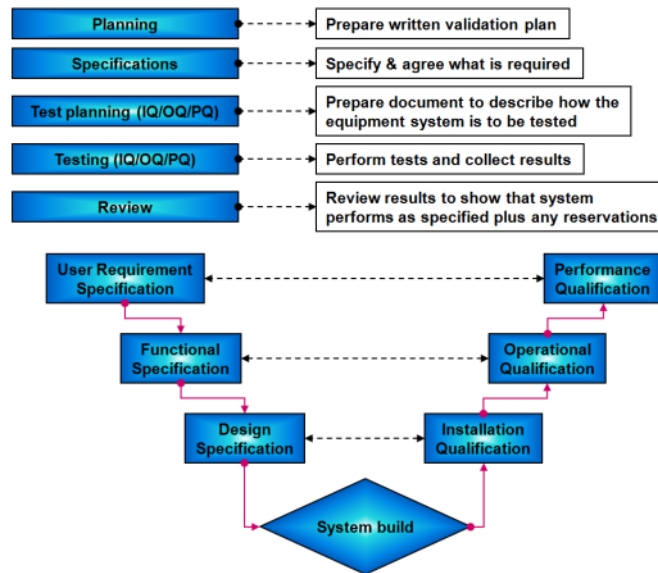
Validation Documentation

- Typical documents packages include Document Index, Quality Plan, GANTT Programme, FDS, HDS, SDS, P&ID Drawings, GA Drawings, Equipment List, Instrument List, Circuit Drawings, Software Code and Test Protocols.



Validation Lifecycle

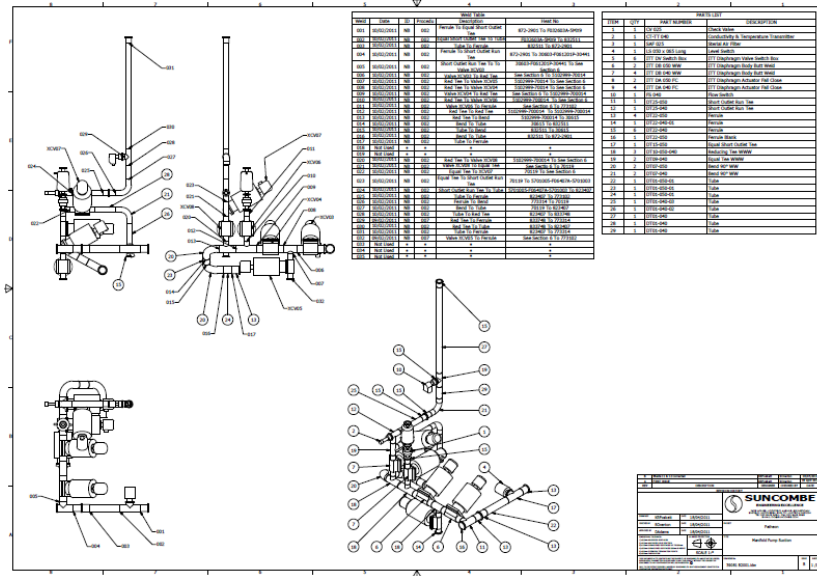
- Our products follow the GAMP Validation Life Cycle with documentary evidence of procedures and processes during design, development, pre-construction, construction and commissioning .



Our Documetation

Weld Validation

- Weld maps and tables linking every weld to its base materials (3.1b), the weld reference, the welder, the welder qualification and the welding machine.



Documentation and DataManual

- Full validation documentation lifecycle. Datamanual including Instruction, Operation and Maintenance manuals, Design Drawings, Schedules and Specifications including all validation documentation.

Our Company Policies

Corporate Responsibility - we set, maintain and promote high standards of corporate responsibility.



Quality - We have a companywide commitment to quality, which is integral to our business culture.



Health and Safety – all work is carried out in accordance with the relevant statutory provisions and all measures taken to avoid risks to our employees or others who may be affected.

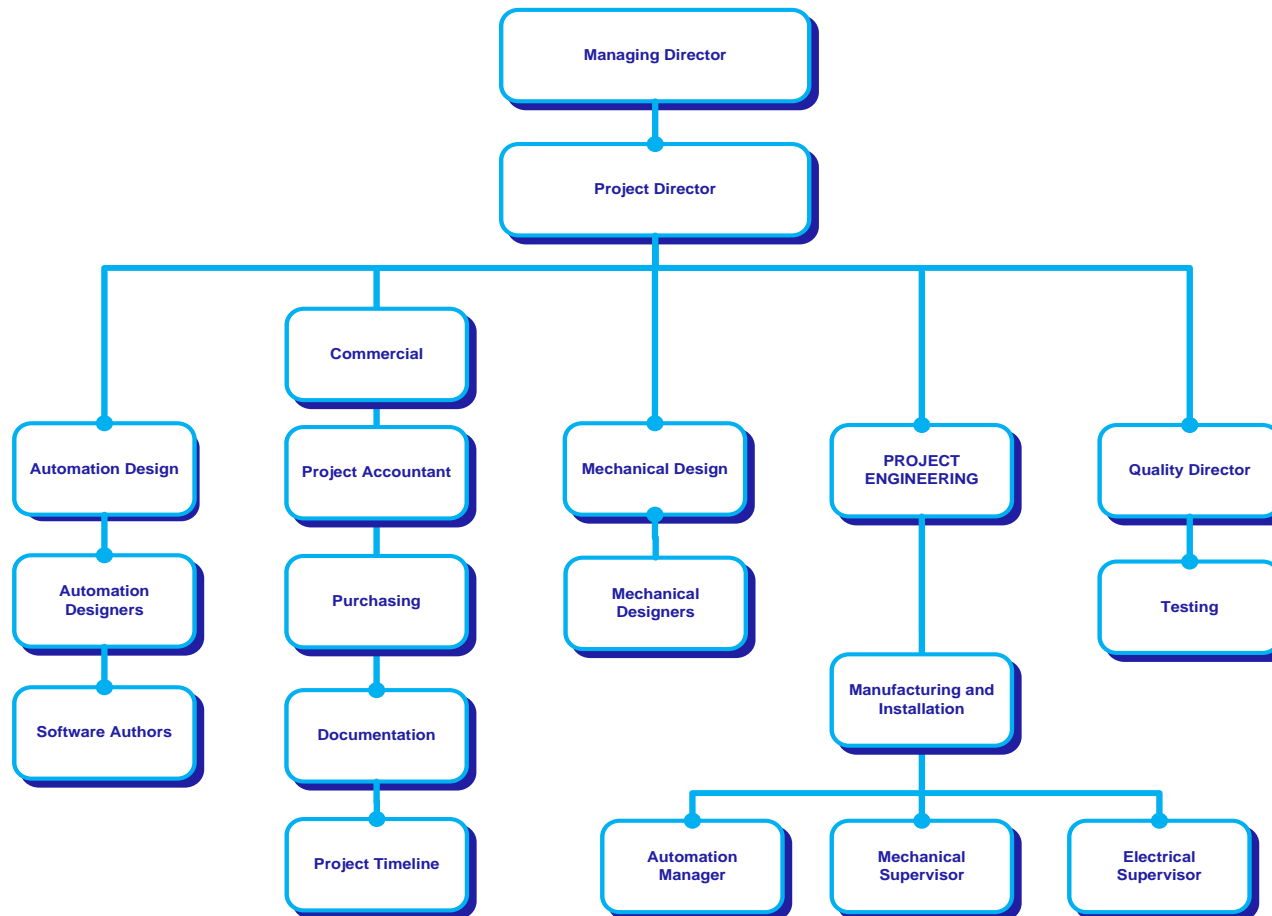


Environmental - Our policy is to wherever possible minimise the environmental impact of our operations.



Our Project Management

Individual Project Teams are selected for every project, with a Project Manager or Project Director as a single point of contact and a single point of responsibility.



Company Overview

- Specialists in CIP, Effluent Treatment, Hygienic Processing, Vessels, Washing, Cleaning & Sterilising
- Engineering Excellence Since 1961
- Custom built equipment based around proven technologies
- GMP design, robust, reliable, high quality
- Worldwide supply through a network of excellent sales and service agents
- UK Design and Manufacture to CE, cGMP, ASME BPE, EHEDG, GAMP, ATEX
- Experienced personnel for all disciplines
- Single point of contact for all aspects of a Project



Our Clientele



Our Values

- We act with integrity and show respect
- We are passionate about our business and our products
- We aim for Engineering Excellence
- We offer Value for Money
- We pride ourselves on Innovative Design
- We offer Quality in everything that we do
- We use robust Health and Safety guidelines
- We strive to continuously increase our Knowledge
- We promote environmentally responsible practices
- We continuously Research and Develop new Innovations



SUNCOMBE
CIP & PROCESS ENGINEERS

Thank You For Your Attention

For More Information Contact Suncombe

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www.suncombe.com

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