Integrated Engineering

Operation and Maintenance Manual

AV Chilled Water Buffer Vessels

CONTENTS

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1 FOREWORD

This manual is a guide for installation, commissioning and maintenance of AV chilled water buffer vessels supplied by Arbe Integrated Engineering Ltd.

It is meant for those who are responsible for the installation, the use and maintenance of the packages. We recommend that you read this manual carefully before commencing any work.

There are five types of chilled water buffer vessels supplied by Arbe Integrated Engineering:

- AVT Range – Traditional chilled water vessels with plain open tank
- AVZ Range – Galvanised steel chilled water vessels with plain open tank
- AVS Range – Chilled water vessels with perforated central baffle plate
- AVP Range – Chilled water vessels with multiple flow baffle plates
- AVX Range – Stainless steel chilled water vessels with plain open tank

The AV range of chilled water buffer vessels store chilled water for cooling. The insulation supplied as standard is polyurethane insulation and encased with a high-strength PVC jacket.

The standard range offers capacities between 100 litres and 5,000 litres.

The AV range of chilled water buffer vessels are generally supplied without ancillaries and should be installed as per the instructions supplied within this manual.

2 INTRODUCTION

This manual is applicable for AVT, AVZ, AVS, AVP & AVX chilled water buffer vessels supplied by ARBE INTEGRATED ENGINEERING.

ARBE INTEGRATED ENGINEERING cannot be held responsible or liable for damage as a result of incorrect installation, use and / or maintenance of ARBE INTEGRATED ENGINEERING thermal stores / buffer vessels as well as not complying with the instructions in this manual.

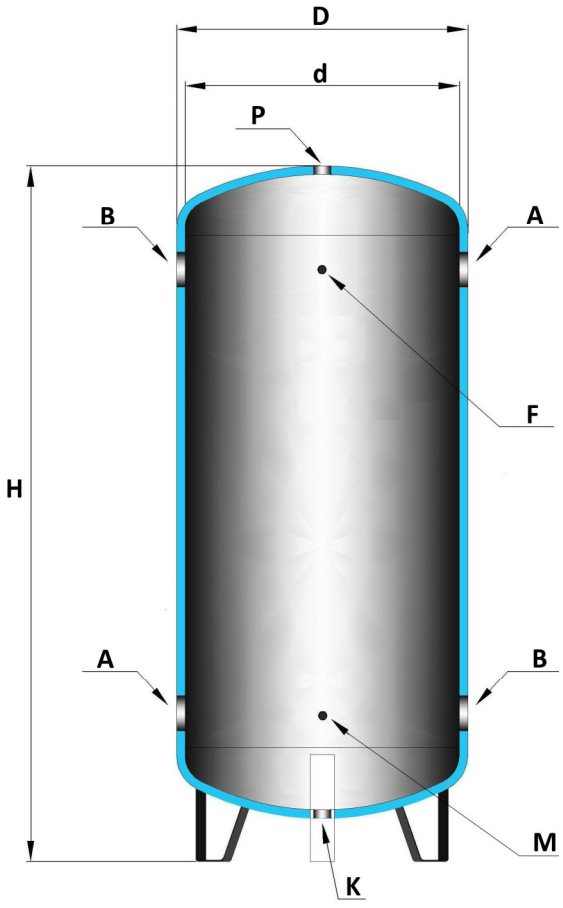
Please note that our vessels are specially designed and built for the operating conditions (pressures, temperatures, capacities and type of fluids) provided by the customer. Sudden pressure peaks beyond the normal operating pressure (or pressure surges) which can occur during starting up or stopping of the system can severely damage the unit and should be prevented. ARBE INTEGRATED ENGINEERING cannot be held responsible for any damage as a result of any operation deviating from the original design conditions.

Supplier:
Arbe Integrated Engineering Ltd
Unit 19, Halifax Industrial Estate
Marshway, Halifax
HX1 5RW, UK

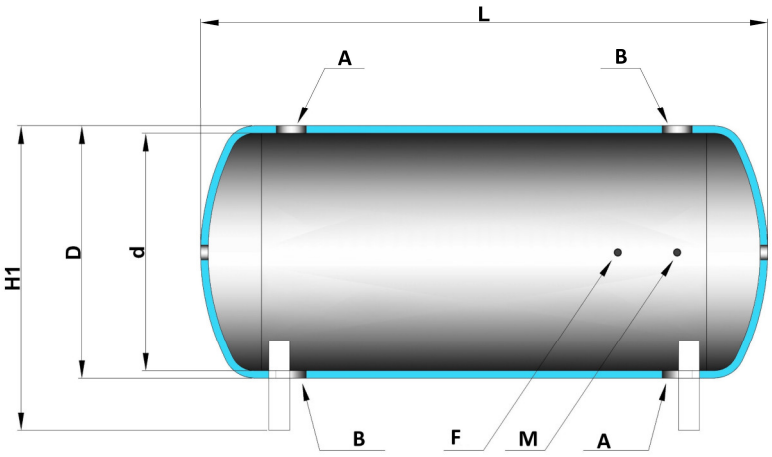
2 INTRODUCTION – AVT & AVZ VESSELS

Dimensions (AVT Carbon Steel)		AVT Capacity (Litres)											
		100	200	300	500	800	1000	1500	2000	2500	3000	4000	5000
D	mm	460	510	610	710	860	860	1000	1150	1300	1300	1450	1650
d	mm	400	450	550	650	800	800	950	1100	1250	1250	1400	1600
H	mm	1050	1470	1520	1800	1890	2140	2430	2480	2580	2780	2840	2930
L	mm	940	1340	1390	1690	1770	2020	2290	2360	2430	2640	2730	2790
H1	mm	590	640	800	890	1040	1040	1180	1330	1480	1540	1680	1870
A - B	BSP	1¼"	2"	2½"	3"	3"	3"	3"	3"	3"	4"	4"	4"
F / M	BSP	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"
K/P	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
Dry Weight - 6 Bar	kg	45	60	70	95	125	135	225	285	310	370	455	615
Dry Weight - 10 Bar	BSP	50	65	85	105	160	170	300	430	475	585	735	950

Dimensions (AVZ Galvanised Steel)		AVZ Capacity (Litres)											
		100	200	300	500	800	1000	1500	2000	2500	3000	4000	5000
D	mm	460	510	610	710	860	860	1000	1150	1300	1300	1450	1650
d	mm	400	450	550	650	800	800	950	1100	1250	1250	1400	1600
H	mm	1050	1470	1520	1800	1890	2140	2430	2480	2580	2780	2840	2930
L	mm	940	1340	1390	1690	1770	2020	2290	2360	2430	2640	2730	2790
H1	mm	590	640	800	890	1040	1040	1180	1330	1480	1540	1680	1870
A - B	BSP	1¼"	2"	2½"	3"	3"	3"	3"	3"	3"	4"	4"	4"
F / M	BSP	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"
K/P	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
Dry Weight - 6 Bar	kg	47	64	75	102	135	148	240	305	330	395	500	675
Dry Weight - 10 Bar	BSP	52	69	90	112	170	183	315	450	495	610	780	1010



Model	Maximum Pressure	Maximum Temperature
AVT-6B	6 BarG	-10 DegC / Ambient
AVZ-6B	6 BarG	-10 DegC / Ambient
AVT-10B	10 BarG	-10 DegC / Ambient
AVZ-10B	10 BarG	-10 DegC / Ambient



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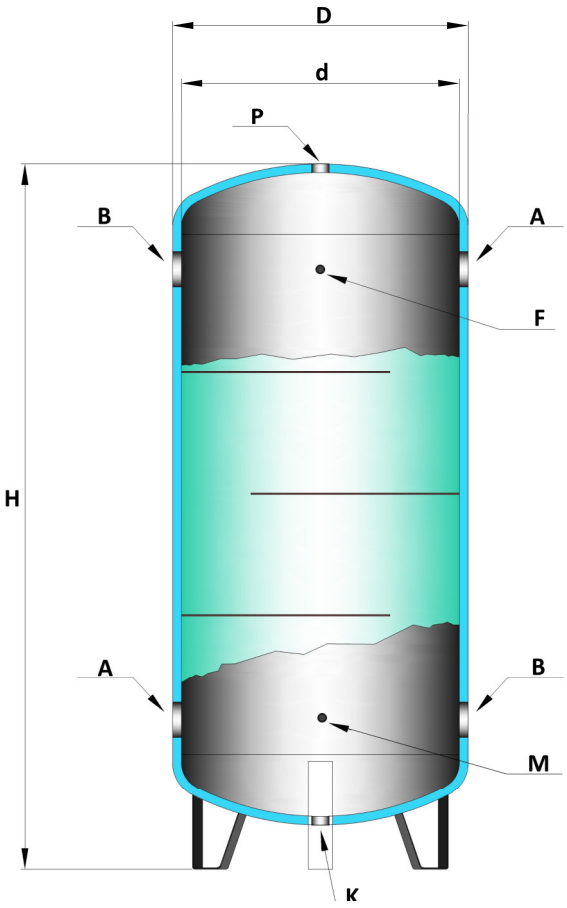
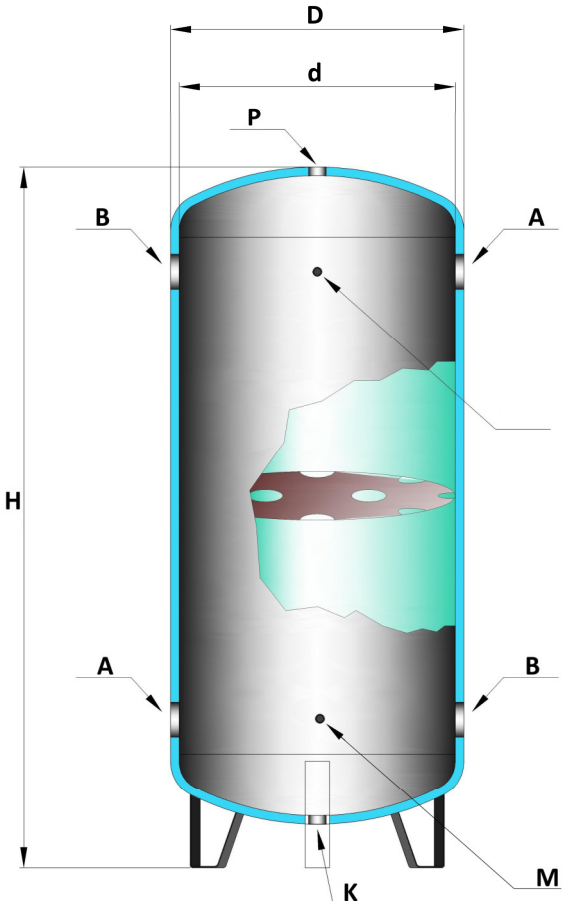
2 INTRODUCTION – AVS & AVP VESSELS

Dimensions (AVS/AVP Carbon Steel)		AVS & AVP Capacity (Litres)											
		100	200	300	500	800	1000	1500	2000	2500	3000	4000	5000
D	mm	-	-	610	710	860	860	1000	1150	1300	1300	1450	1650
d	mm	-	-	550	650	800	800	950	1100	1250	1250	1400	1600
H	mm	-	-	1520	1800	1890	2140	2430	2480	2580	2780	2840	2930
A - B	BSP	-	-	2½"	3"	3"	3"	3"	3"	3"	4"	4"	4"
F / M	BSP	-	-	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"
K/P	BSP	-	-	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
Dry Weight - 6 Bar	kg	55	70	80	105	135	150	240	305	330	390	475	650
Dry Weight - 10 Bar	BSP	60	75	95	115	170	185	315	450	495	605	755	985



AVS Buffer Vessel



AVP Buffer Vessel

Model	Maximum Pressure	Maximum Temperature
AVP-6B	6 BarG	-10 DegC / Ambient
AVS-6B	6 BarG	-10 DegC / Ambient
AVP-10B	10 BarG	-10 DegC / Ambient
AVS-10B	10 BarG	-10 DegC / Ambient

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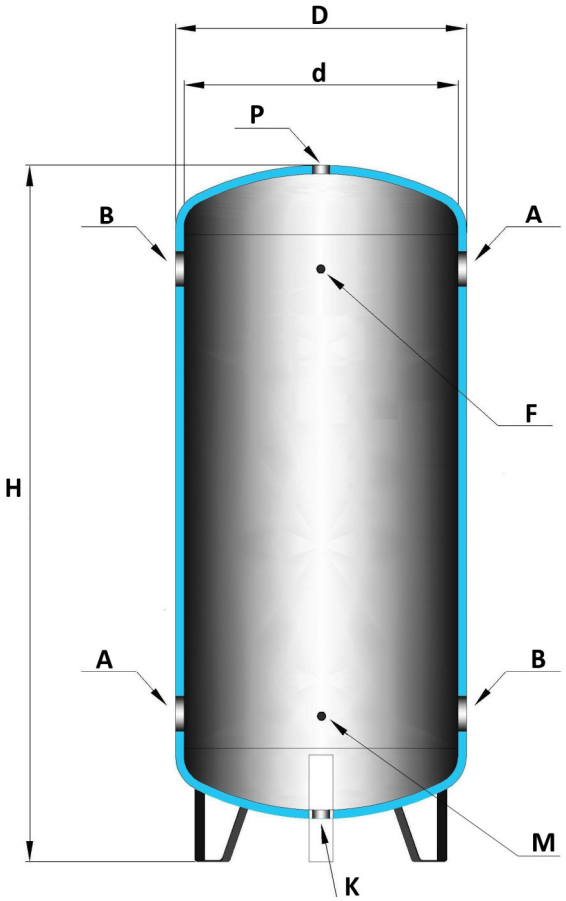
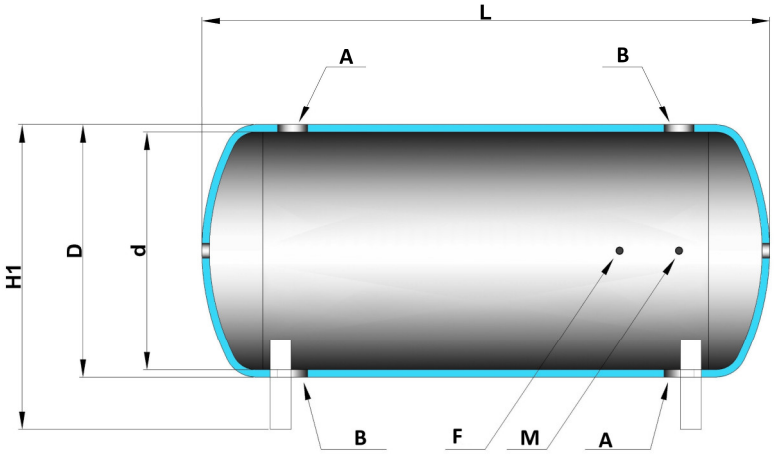
2 INTRODUCTION – AVX VESSELS

Dimensions (AVX Stainless Steel)		AVX Capacity (Litres)											
		100	200	300	500	800	1000	1500	2000	2500	3000	4000	5000
D	mm	460	510	610	660	860	860	990	1140	1140	1290	1440	1640
d	mm	400	450	550	600	800	800	950	1100	1100	1250	1400	1600
H	mm	970	1395	1440	1880	1870	2120	2385	2430	2730	2750	2810	2840
L	mm	900	1325	1370	1810	1770	2020	2285	2330	2610	2630	2960	2720
H1	mm	580	630	730	830	1080	1080	1180	1330	1480	1480	1680	1880
A - B	BSP	1¼"	2"	2½"	3"	3"	3"	3"	3"	3"	4"	4"	4"
F / M	BSP	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"	½"
K/P	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
Dry Weight - 6 Bar	kg	45	55	60	85	125	135	215	260	285	340	380	535
Dry Weight - 10 Bar	BSP	45	55	60	95	145	155	255	310	395	525	585	820

Model	Maximum Pressure	Maximum Temperature
AVX-6B	6 BarG	-10 DegC / Ambient
AVX-10B	10 BarG	-10 DegC / Ambient





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2 INTRODUCTION – INSULATION

The range of chilled water buffer vessels supplied by Arbe are insulated with 2 different types of insulation, depending on the capacity of the vessel. Vessels are finished in a PVC casing as standard, suitable for internal applications only or with Stucco aluminium cladding as an option, for applications where the vessel is to be installed externally or a stronger jacket is specified or required.

Hard Foam Polyuethane (PU)
The insulation is made from hard polyurethane (PU). The foam has more than 93% of closed-cell content and is CFC and HCFC free.

The insulation is directly injected using a mould or it can be made in 2 removable shells, each 1 half of the vessel.

Closed-Cell Elastomer
The insulation is made up from closed-cell cross-linked polyurethane, CFC-free, asbestos-free and odour-free. It is resistant to water vapour diffusion, chemical agents, mould, parasites, ozone, weathering and UV rays.

It is used is insulate ther chilled water chilled water tanks as it allows to protect the vessel material from condensation.

Material Insulation	Thickness	Density kg/m³	Thermal Conductivity Coefficient at 45°C	Working Temperature	Fire-Resistance (Euroclass EN13501-1)
Hard Foam Polyurethane	30mm	40-42	λ = 0.019 W/mK	-10°C / Ambient	F
Closed Cell Elastomer	20mm	30	λ = 0.032 W/mK	-10°C / Ambient	C-s3,d0

3 HEALTH & SAFETY NOTICES

YELLOW TRIANGLE
Refer to applicable SAFETY ALERT notices within the manual!
All SAFETY ALERT notices are applicable to personal injury and identified by the following symbol.

Please be aware of the following potential hazards, which could be present during installation, commissioning, servicing and operation:

- Injury hazard from heavy/sharp objects during installation. Plan and execute the installation with care
- Injury hazard from pressure-containing parts. In general, before working on pipework or other pressure-containing parts, isolate and drain them. Never exceed the maximum working pressure of the unit
- Electrical hazard (If anti-frost immersion heaters fitted). The unit uses mains voltage electricity, either 240v 1 phase or 400v 3 phase. External voltages may be fed to the units which are not isolated by the unit isolator. Equipment on the unit may operate automatically without warning
- Mechanical hazard. The unit may have moving parts. Equipment on the unit may operate automatically without warning
- Scalding hazard. The equipment may contain very hot water at pressure. Surfaces may be hot

The unit must only be worked on by suitably qualified and trained personnel. Checks to ensure electrical safety should be carried out by a competent person.

When doing service work on the package equipment

- Deactivate any pumps and immersion heaters and turn off the power
- Close the shut off valves
- **Fully reduce the pressure in the piping system and allow pipes to completely cool down**

If necessary, disconnect the electrical wires. Before putting the systems back into operation again, make certain that all equipment is fitted correctly and shut off valves re-opened.

- Make the following checks for correct operation.
- With the system hot, examine all water connections for soundness.
- Carry out equipment general checks (see specific equipment section)
- Balance the system.

4 PRESSURE EQUIPMENT DIRECTIVE CERTIFICATE

The standard range of AV chilled water buffer vessels are designed in accordance with the requirements of the Pressure Equipment Directive 2014/68/CE Art. 4.3. Units classed as SEP in the PED category are not supplied with a CE mark. Units in category I & II are CE marked and appropriate markings and certification is supplied with each unit.

It is the responsibility of the user and/or installer to ensure that the unit is installed and operated safely, and in accordance with the instructions supplied within this manual. The standard AV chilled water buffer vessels range is designed for a water medium in the shell.

EC DECLARATION OF CONFORMITY

We

Supplier Name: Arbe Integrated Engineering Ltd
Address: Unit 19, Halifax Industrial Estate, Halifax
Country: England

declare, in sole responsibility, that the following equipment

Product: AV Chilled Water Buffer Vessels
Country of Origin: Italy/UK

are in accordance with the requirements of the Pressure Equipment Directive 2014/68/CE

Certificate Number: PED-AV-20
Date of Issue: April 2019

Applicable Standard: 2014/68/CE – Art 4.3

Subject products are designed, manufactured and tested according to the appropriate quality control procedures

Date: 28/04/20
Rob Brownless
Arbe Integrated Engineering

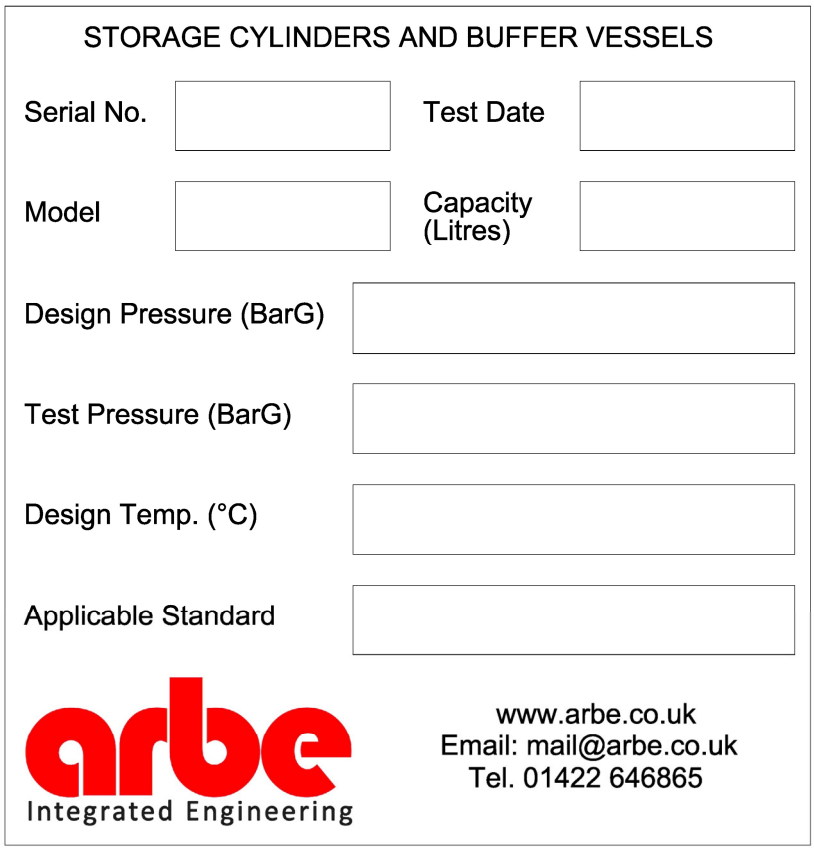
Size (Litres)	Fluid Group	PED Category	Module
All sizes ranging from 100 to 5,000 Litres	Chart 4 Group 2 Liquids	SEP	A

5 GENERAL

5.1 Identification of the Unit

All chilled water buffer vessels supplied by ARBE INTEGRATED ENGINEERING are provided with a name plate. On this plate the following details are specified:

- Serial number
- Test date
- Model
- Capacity
- Design pressure
- Test pressure
- Design temperature
- Applicable standard



5 GENERAL

5.2 Lifting & Handling

Use lifting lugs where fitted. Do not lift a vessel using the insulation where fitted. Straps may crush or damage the insulation casing. Due to the insulation casing material thickness, care should be taken when moving and handling the vessel not to damage the insulation. Do not lift the vessel using chains directly in contact with the shell. Do not allow operatives to stand on the vessel

5.3 Siting & Assembly

Unless specifically ordered for an external installation, the vessel must be sited indoors. Foundations or plinths must be firm and level to prevent settling, pipe strain or distortion of the shell. Unless specifically ordered differently, the vessel must be installed in a level position.

On sectional cylinders, the bolting of sections must be carried out in a diametrically-opposite sequence to ensure even tightening of the bolting. Should the cylinders ever need to be dismantled, a new set of body gaskets would be recommended to be used to ensure sealing

Protective covers and plugs may be fitted to connections to protect them in transit. These must be removed prior to use. If a connection is not required, seal it appropriately. Check for any foreign material which may have got into the vessel. Pipework connected to the vessel must be adequately supported to prevent any loads being transmitted to the vessel.

Provide for thermal expansion with bends and expansion joints. Fit isolation valves prior to the vessel connections to facilitate servicing (NOT TO THE VENT). For flanged connections, tighten bolts in a diametrically opposite sequence to load the flanges evenly onto the gasket. Ensure adequate venting for air removal during filling and operation (pressurised systems should have an automatic air vent and a manual air vent for this). Safety valves should have their discharge pipes away to a safe disposal point, preferably via an air-break and tundish so that the discharge unrestricted and easily visible.

In unvented or closed systems, water expansion must be accommodated by a separate expansion vessel fitted in the system on the cold feed line. We would recommend the use of a pressurisation unit on large systems, especially systems with high operating temperatures above 100^{o}C where the possibility of steam flashing can occur due to pressure loss in the system

With reference to the fixing down of the unit, please note that the legs or brackets SHOULD NOT be welded to a base plate or structure and should always be fixed down using brackets and bolts. Any modification to any part of the package where welding or brazing has been carried out may invalidate the warranty of the unit (please refer to the warranty section of the manual

6 COMMISSIONING AND OPERATION

6.1 Commissioning & Operation

Do not operate the equipment at pressures or temperatures in excess of those specified on the nameplate or the vessel marking. Do not subject the vessel to conditions of vacuum or partial vacuum. For example, partial vacuum may occur if draining the vessel when valves fully or partially closed.

1. It is assumed that the pipework is already full of water
2. Start with all valves closed and circulation pumps off
3. Close the drain valve
4. Ensure the automatic air vent is operational
5. Open any manual vent valves
6. Open the main system connection valve and slowly fill the vessel with water
7. Shut the manual vent valve when water appears from it
8. Carefully open all the other system connections valves

Check that all gaskets are effective when the unit is operating - some bolt tightening may be necessary after the unit has been first heated and subsequently from time to time. Following installation and commissioning it is advisable to remove, clean and re-assemble any strainers.

All fluids must be drained when the unit is out of operation to prevent freezing or possible corrosion.

Warning: to avoid any “water hammering”, open the valves gradually; sudden accelerations of fluid could cause increases in pressure many times greater than the working pressure.

6.2 Maintenance

The AV chilled water buffer vessels are designed to operate efficiently with a minimum of attention. A regular maintenance programme will ensure continued high operating efficiency and trouble-free operation.

Always disconnect the power supply before carrying out any maintenance on the unit

Expansion Vessel

- Biannually check the pre-charge pressure of the expansion vessel; the same value established during the system installation must be always maintained
- Restore the air cushion to the initial valued in order to ensure an efficient protection of the installation from overpressure

6.3 Draining the Cylinder

GENERAL POINTS :-
It is recommended that a set of gaskets for the inspection opening (if fitted) be carried for use when the unit is stripped down for insurance inspection, or cleaning

Maintenance of the destratification pump and other ancillary equipment should be carried out in accordance with the instructions supplied for these items by their respective manufacturers. Copies of these are included with these instructions

To drain the cylinder down

1. Obtain a complete set of replacement gaskets from Arbe Integrated Engineering
2. It is assumed here that all isolation valves (except drain) are open at the start
3. Switch off any system circulating pumps and isolate any immersion heaters
4. For closed systems reduce the residual cylinder pressure by manually operating the safety valve - some hot water will come out!
5. For closed systems open a manual vent valve to allow air in during drain-down

It is imperative that if the unit has been installed with an anti-vacuum valve, this should be checked to be operational whilst starting to drain down to avoid and vacuuming within the vessel which would cause catastrophic failure of the shell

9 WARRANTY

Further to conditions contained within our standard terms and conditions of sales, please see below the warranty details for the range of AV chilled water buffer vessels

9.1 Warranty
Arbe Integrated Engineering guarantees its products according to EU Regulations, on condition that all the installation, operational and maintenance requirements are adhered to and carried out, and that all technical specifications indicated by us are complied with.

The duration of the warranty shall start from either:

- The date of delivery should the package not be commissioned by a qualified engineer carried out by Arbe Integrated Engineering.
- The date of commissioning and hand-over to the customer should the package be commissioned by Arbe Integrated Engineering.

Any modifications or changes made to the cylinder shall invalidate any warranty or guarantee should this not be approved in writing from Arbe Integrated Engineering.

The warranty shall cease on the unit in the event the following points are not complied with:

- Any part of the cylinder is modified or altered without prior written consent of Arbe Integrated Engineering.
- Items on the vessel such as the drain pipe support are removed.
- Welding of the vessel legs to a base. The vessel should be bracketed and bolted.
- There is a non-compliant installation within the system such as isolating valves on vent valves and inadequate expansion control and valving on closed systems.
- The design parameters of the package are exceeded, such as pressure & temperature.

Please note that any issues with the package caused by poor water quality is not covered with this warranty, including:

- Scaling or blockages in hard water areas.
- Damage to the cylinder and associated equipment from additives such as chlorine dioxide.
- Debris within the water as on unfiltered borehole water systems etc.