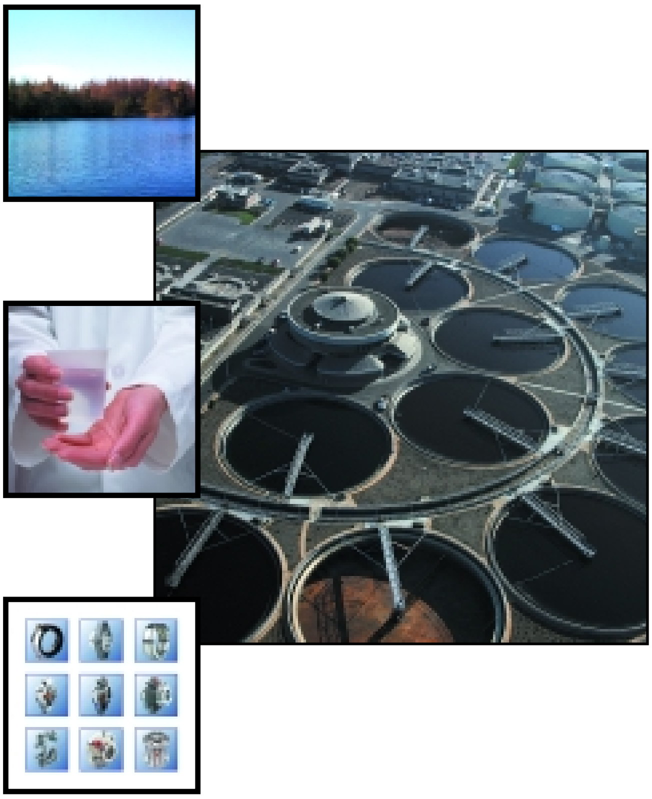
AESSEAL®

ENVIRONMENTAL TECHNOLOGY

A Guide to Sealing the WATER AND WASTE INDUSTRY



- WASTE WATER TREATMENT PROCESS
- POTABLE WATER SYSTEMS
- SEAL SELECTION
- CASE HISTORIES

CONTENTS

Note for water & waste booklet.

Raw sewage is usually non-abrasive and the solids are usually relatively large. On very rare occasions sewage which is heavy with sand and grit can require hard faces.

Raw sewage normally encountered outside the sewage treatment works requires C/CRO2 faces and single seals have lasted more than 10 years on this type of duty. AESSEAL® has over twenty years experience in this industry.

Based on our experience over 90% of applications outside the treatment works should be sealed with Carbon / Chrome Oxide faced and a single seal without flush.

Sludges are encountered within the boundaries of the sewage treatment works where the water content is progressively decreased in favour of solids content. These products normally require hard faces.

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Introduction

The pollution of waterways, drinking water supplies and other environmental issues are dominating our newspapers, television screens and political reports every day.

The treatment and disposal of waste water and sewage and the production of quality drinking water has never before been so much in the public eye.

The extraction of contaminants and the returning of a clean, high quality water to our rivers and waterways, in addition to the filtration and purification of potable waters is, therefore, of paramount importance.

To this end, the installation of reliable, leak free equipment can be utilized to contain products and prevent unnecessary leakage of unwanted contaminants. These contaminants may cause, at best, housekeeping and 'clean up' problems and increased costs, and at worst, pollution in their own right.

When the operating of leak-free rotating equipment is under consideration, a cost effective solution to gland sealing must be considered and in this document we aim to suggest ways in which this area can be addressed.

Waste Water Treatment

The removal of contaminants from waste water can take many forms.

The contaminants themselves may be varied in source and concentrations, ranging from sewage and land drainage to industrial effluents. It is true to say, however, that large scale industrial effluents are neutralized and treated on site prior to disposal. This, therefore, leaves mainly sewage and land drainage to be handled at the Treatment Works. The following is a basic flow description for a 'typical' system, as all have their own peculiarities.

The plant inlet is fed via local Pumping Stations on residential areas and industrial estates. These gather effluent and sewage, via the Sewage system, into wells from individual properties and pump the material to the Treatment Works Screen pump well or low level pumps. These pumps then supply the system with a continuous flow for treatment. The first stage of the process is to screen the material to remove plastic bags, rags, timber, etc. which would foul the Settling tanks.

The product then passes to a Grit Removal Process, which may involve passing the liquid along channels where the flow is controlled so as to drop the grit out of suspension. The grit is then periodically cleaned from the channels by rakes.

The effluent then passes into the Primary Settling tanks or Sedimentation tanks. Here the sludge content sinks to the bottom and is pumped to the next stage. The supernatant water is allowed to flow over weirs and is collected in a sump.

These two constituents are then treated separately.

(a) The Sludge System

The sludge is first pumped through Macerators where any large particles are reduced in size. The macerated sludge is then pumped into the Sludge Settling tanks where the product is left to separate again. The top water is then pumped into the supernatant water sump whilst the solid content is pumped to centrifuges where the de-watering process is then completed. The solid content is then incinerated, placed in lagoons, or transported via barges or tankers.

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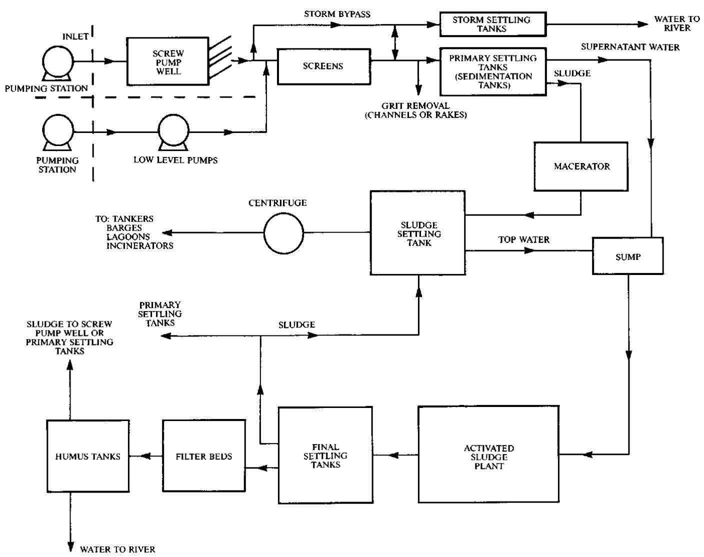
(b) The Supernatant Water System

The supernatant water is first pumped from the collecting sump into the activated sludge plant where the product is aerated and then passed through the Micro-organism tank where the process starts to break down any impurities and drop them from the water as a sludge. The water and sludge mixture then passes through the Final Settling tanks where the sludge content is returned to the Sludge Settling tank or the Primary Settling tank to be treated once again. The water is either fed to filter beds to finally clean the water, or to Humus tanks to finally settle out any remaining sludge, or is passed to the river.

Plant peculiarities may be in the form of storm bypass lines which will divert high flow levels away from a piece of plant which may cause flooding in certain weather conditions, for example, the Screening plant or the Primary Settling tanks.

Storm Settling tanks may be installed and feed the sludge content to the Primary Settling tanks and the water to the river. It is to be remembered, however, that in storm conditions the clean water content in the system is extremely high and the sewage content by percentage is low.

Typical Sewage Treatment Works Flow Chart



Potable Water Systems

The system selected to treat potable water is dependent on the incoming source. This may be Reservoir, River or Bore hole.

The water condition from these sources varies drastically. Add to this the possible geographical locations for each source and a very complex picture emerges.

The contaminants in source water may be dissolved from rock strata, washed from moorland peat lands or produced by farm activities, i.e., ploughing and burning.

Treatment Processes

(1) Single Stage - A single stage treatment process may consist of Slow Sand filters in which the water is allowed to percolate through the sand bed. The water would then be treated chemically. This system may still be found in Southern England treating river water.

To supersede the Slow Sand filters in single stage treatment, enclosed Pressure filters were introduced. The first advantage was that of maintaining the reservoir head pressure

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into the distribution system and so reducing the pumping costs. The filter works by mixing the incoming water, probably a reservoir supply, with coagulants of, generally, Aluminum Sulphate and Lime for pH correction, as the pH determines the level of colour turbidity, Iron and Aluminum removal. These mix above the filter media and the floc is then removed as the water flows through the filter material. The filter is backwashed periodically to removed the floc build-up.

More lime is then added to increase the pH to around 8 - 9. Chlorine is then added for disinfection and the water is then passed to the distribution network.

(2) Two Stage Treatment - The reservoir feed water flows, usually by gravity, into the inlet screen chamber. This is combined with any washwater coming from the final filtration Tanks. This water is then passed into the inlet mixing chamber where dosing takes place. Lime is normally used to correct the pH prior to the coagulant dosing in the flash mix chamber.

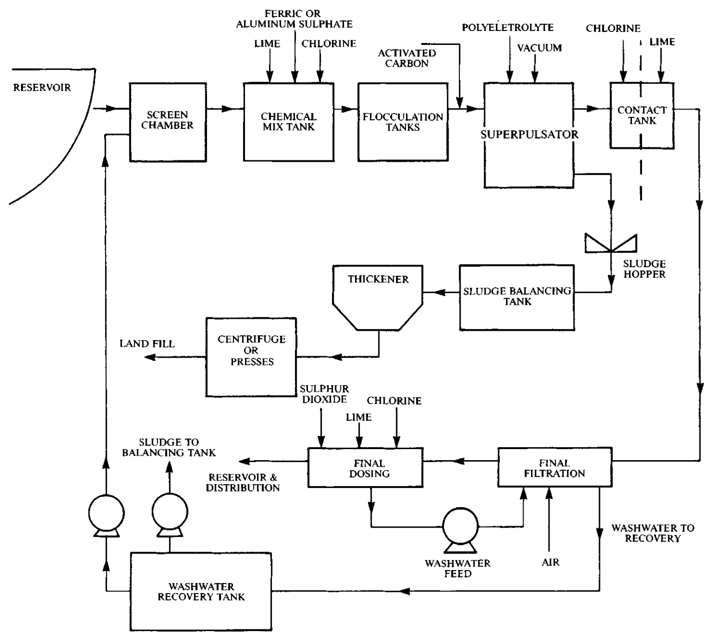
In the flash mix chamber the coagulant (typically either Ferric Sulphate or Aluminum Sulphate), is rapidly dispersed by mechanical mixers and together with the lime dose additions, the optimum flocculation pH is obtained. Chlorine may also be added to break down algae growths at times of high bacteriological load.

The mixture then enters the Flocculation tanks where the formulation of the floc is generated prior to clarification in the superpulsator clarifiers.

If taste and odour are present from algae, then dosing with Powdered Activated Carbon at this point may be needed. The water is then distributed over a weir into the superpulsator and is introduced into the base of the unit via pipes. The water then flows upwards and between plates where the flocculent deposits a sludge blanket. This is formed by the upwards force of the water pushing against the downward force of the sinking floc. The sludge blanket is, therefore, formed in the middle section of the vertical baffle plates. This blanket then becomes the filter through which the water and floc mixture have to pass. To aid in this process, Polyelectrolyte may be added. The clarified water is then extracted in the lateral pipes in the top of the unit.

The superpulsator is also operated with a vacuum in the sealed inlet chamber above the water level. The water level, therefore, rises and once a certain level is reached the vacuum is released sending a pulse of water through the unit, hence the name superpulsator.

Typical Two Stage Treatment System



This action helps the formation of the sludge blanket by giving it a 'gentle shake'. The sludge generated travels along the dividing walls and into hoppers below the outlet channels where it is bled off to give constant blanket conditions.

The clarified water is passed to the contact tank. Chlorine is most effective as a disinfectant at low pH, therefore, it is added prior to final pH elevation. Chlorine is dosed at the inlet to the contact tank so that disinfection can occur and lime is then dosed in the second portion of the contact tank. The elevation in pH, again coupled with the free Chlorine, brings about rapid oxidization of the manganese compounds which are converted to insoluble oxides and are removed in the Second Stage Sand filters. The Second Filter Stage Rapid Gravity filters consist of either Sand or Sand/Anthracite beds. These are designed to give a high filtration rate. The water is then finally dosed with 'trim' doses of lime or chlorine as necessary and fed to distribution.

The Rapid Gravity filters are washed by first purging them with air to loosen the bed, then flushing them with high flow washwater which is then returned to the plant inlet via Washwater Recovery tanks.

The bled sludge and heavy deposits from the washwater are thickened and either pressed or centrifuged and the solids are then used as land fill.

(3) Three Stage - This process gives more opportunity to optimize processes and reduce or eliminate the need for polyelectrolytes.

The three stage system employs an additional first stage. The water is first passed to Flash Mixing tanks where Lime and Ferric Sulphate or Aluminum Sulphate are added. Used washwater is also introduced at this point. The mixture then enters the flocculation stage where the pin-point particles form the floc. This stage promotes growth of floc into large floc ready for removal in the Treatment Plant. The flocculent removal stage is done by the dissolved air flotation.

Water leaves the Flocculation tank and travels downwards towards the bottom of the Flotation unit where water, saturated with air, is injected through nozzles into the main stream of water. This is then passed under the inlet baffle and is directed towards the surface by an angle baffle. As the saturated water enters the main stream of water, a pressure drop across the nozzle induces the dissolved air to come out of the solution. Microscopic bubbles are formed which attach themselves to the floc and float to the surface. The sludge is scraped from the tank at intervals.

This flocculation stage can be targeted for optimum colour removal and the subsequent filtration stages are based on the Two stage system or two Rapid Gravity Filter systems.

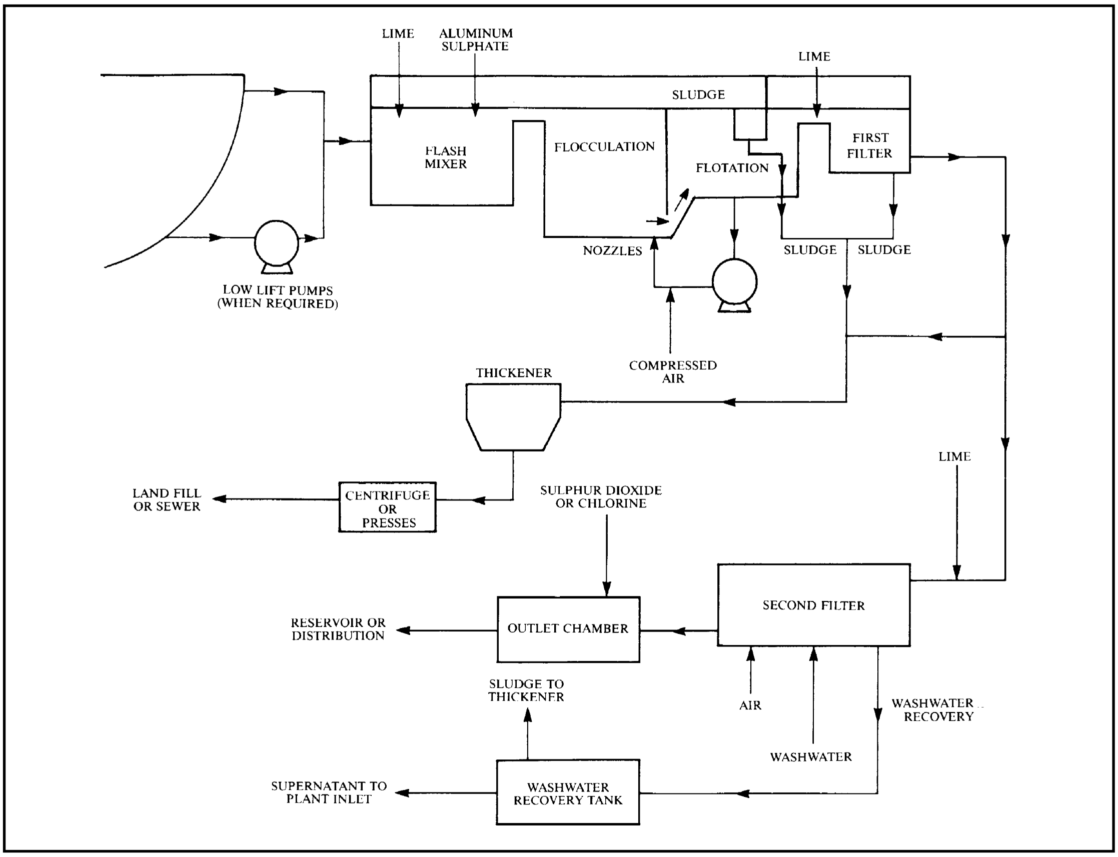
(4) Cascade System - Bore hole water has a very low oxygen level, which must first be increased. This is done by pumping the water into cascade aerators. A three stepped cascade is utilized at many Treatment Works. This action oxidizes the Manganese and Iron content in the water. Chlorine and Potassium permanganate are added to further oxidize these elements. Caustic Soda is then added to increase the alkalinity to the optimum level for removal in the filters.

The water is then passed through an Oxidation tank where it is allowed to flow slowly through whilst the added chemicals react and the Iron and Manganese form particles that are in suspension not solution.

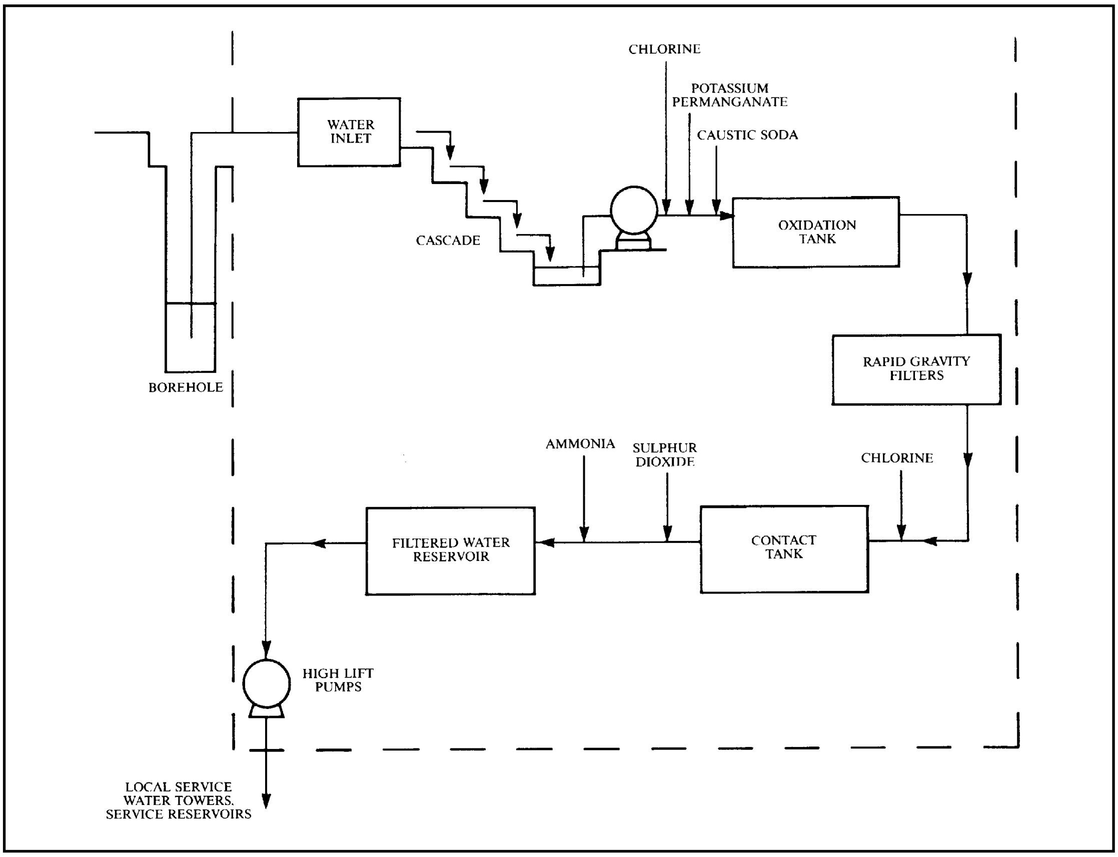
The product is then passed through Rapid Gravity Filters to remove these particles. The water is then chlorinated in the Contact tank. The dosing of Sulphur Dioxide after the disinfection reduces the Chlorine level to a suitable parameter for drinking water.

Finally, Ammonia is added to change the Chlorine to Chloramines which persist longer in the Mains system and cause less taste problems. The water is then stored and distributed.

Typical Three Stage Treatment System



Typical Cascade Treatment Method



Horizontally Aligned Pumps

Product	Preferred Seal type	Face Material	Environmental Controls	Drawing	Comments
Raw Sewage	Cartridge with flush port	Car/Ch.Ox.		4	
Supernatant Water	Cartridge with flush port	Car/Ch.Ox.		4	
All Sludge	Cartridge with flush port	TC/TC	Water flush if available will extend seal life	4	Opening out the seal chamber clearances will improve life
Clean Water	Cartridge with flush port	Car/Ch.Ox.		4	
Storm Water	Cartridge with	Car/Ch.Ox.		4	If a high grit content is present use TC/TC

Vertically Aligned Pumps

Product	Preferred Seal type	Face Material	Environmental Controls	Drawing	Comments
Raw Sewage	Cartridge with flush port	Car/Ch.Ox.	See Below	4 or 5	
Supernatant Water	Cartridge with flush port	Car/Ch.Ox.	See Below	4 or 5	
All Sludge	Cartridge with flush port	TC/TC	Water flush if available. See Below	4 or 5	Opening out the seal chamber clearances will improve life
Clean Water	Cartridge with flush port	Car/Ch.Ox.	See Below	4 or 5	
Storm Water	Cartridge with flush port	Car/Ch.Ox.	See Below	4 or 5	If a high grit content is present use TC/TC

*** Note: with all vertical applications air locking in the seal chamber is a possibility.**

Check with your Sales Engineer whether a flush, air bleed or lubrication fluid with a secondary seal is required at the seal faces.

RAW SEWAGE: Is not normally sufficiently abrasive to wear Carbon - Therefore in most cases Carbon/Chrome Oxide is the preferred face combination. (See note on page 2).

SLUDGE APPLICATIONS: Hard faces (TC/TC) are required.

STORM WATER APPLICATIONS: Hard faces are only required where the grit content (in the stuffing box) is liable to wear Carbon.

VERTICAL APPLICATIONS: Where dry running is encountered, an effective air bleed system, flush or double seal system (barrier fluid system) are essential.

FLUSH: A clean water flush system is seldom used in sealing Water and Waste Treatment applications. It is not normal practice to use a flush, but where it can be used a flush or barrier fluid system will extend life in sludge applications.

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Seal Selection

Chemical	Temperature	Concentration	Metallics	Face	Elastomer	Seal Type	Alternative	Case History
Leachate	Ambient	100%	AISI 316L	SiC/SiC	Viton	CURC™		Sewage and Waste Water
Polyelectrolite	Ambient		AISI 316L	SiC/SiC	Viton	CURC™		Sewage and Waste Water
Sewage (Raw)	20°C (68°F)		AISI 316L	C/CR02	Viton	CURC™		Sewage and Waste Water
*Sewage	<70°C (158°F)	<6%	AISI 316L	TC/TC/CR02/C	Viton	CDSA™		Sewage and Waste Water
Sewage Sludge >6% (Activated)	<70°C (158°F)	>6%	AISI 316L	TC/TC/CR02/C	Viton	CDSA™		Sewage and Waste Water
Sewage Sludge >6% (Raw Activated)	<70°C (158°F)	>6%	AISI 316L	TC/TC/CR02/C	Viton	CDSA™		Sewage and Waste Water
Sewage Sludge >6% (Surplus)	<70°C (158°F)	>6%	AISI 316L	TC/TC/CR02/C	Viton	CDSA™		Sewage and Waste Water
Sewage Sludge (Activated)	<70°C (158°F)	<6%	AISI 316L	TC/TC	Viton	CURC™		Sewage and Waste Water
Sewage Sludge (Deactivated)	<70°C (158°F)	ALL	AISI 316L	TC/TC	Viton	CURC™	CURE™ Plan 52	Sewage and Waste Water
Sewage Sludge (Digested)	<70°C (158°F)	ALL	AISI 316L	TC/TC	Viton	CURC™+PLAN 32		Sewage and Waste Water
Sewage Sludge (Final Effluent)	<70°C (158°F)	ALL	AISI 316L	TC/TC	Viton	CURC™	CURE™ Plan 52	Sewage and Waste Water
Sewage Sludge (Including Grit)	<70°C (158°F)	ALL	AISI 316L	TC/TC	Viton	CURC™	CURE™ Plan 52	Sewage and Waste Water
Sewage Sludge (Raw Activated)	<70°C (158°F)	<6%	AISI 316L	TC/TC	Viton	CURC™		Sewage and Waste Water
Sewage Sludge (Raw Including Humus no Grit)	<70°C (158°F)	ALL	AISI 316L	C/CR02	Viton	CURC™		Sewage and Waste Water
Sewage Sludge (Surplus)	<70°C (158°F)	<6%	AISI 316L	TC/TC	Viton	CURC™		Sewage and Waste Water
Sewage Water	30°C (86°F)	80%	AISI 316L	C/CR02	PTFE	MO1™		Sewage and Waste Water
Storm Water	Ambient	<1% GRIT	AISI 316L	C/CR02	Viton	CURC™		Sewage and Waste Water
Storm Water (>1%<6%)	70°C (158°F)	>1%<6%	AISI 316L	TC/TC	Viton	CURC™		Sewage and Waste Water
Storm Water (No Grit)	Ambient	<6% Solids	AISI 316L	C/CR02	Viton	CURC™		Sewage and Waste Water

***Sewage on PCP's with Stuffing box at Discharge Pressure.**

Pump and Seal Design

As can be seen from the seal selection guide, cartridge internal mechanical seals offer the easiest to install, non clogging, non shaft fretting solutions to most problems. However, there are times when pump design will not allow the installation of cartridge type seals. A two part seal must then be employed.

It should be noted that stuffing box/seal chamber and system design can greatly influence effective mechanical seal life. None of these factors are controlled by a seal manufacturer.

In this next section the seal designs named in the seal selection guide are shown to aid in the understanding of how the problems of successfully installing reliable mechanical seals in the industry can be overcome.

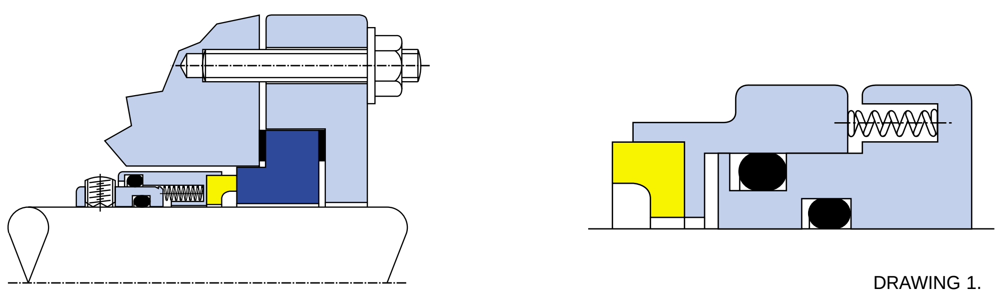
Pump design plays an important role in the successful life of the seal. We are pleased to incorporate drawings supplied by major pump suppliers to the industry, showing the installation of AESSEAL® seals.

Seal Type	Drawing Number
SAI™ / USI™ + NCE™	1
CONVERTOR II™	2
SCUSI™	3
CURC™	4
CRCO™	5
RDS™	6
SMSS™	7

Pump Type	Drawing Number
S Adams Vertical Pump	7
Wallwin 1094	8
Worthington Simpson 'L' Type Pump	9
Worthington Simpson 'U' Type Pump	10
SPP Freestream	11
SPP ED12	12
Weir Uniglide	13

SAI™ VERSUS USI™ STATIONARY, NCE™

SAI™ VERSUS USI™ *NCE™*



DRAWING 1.

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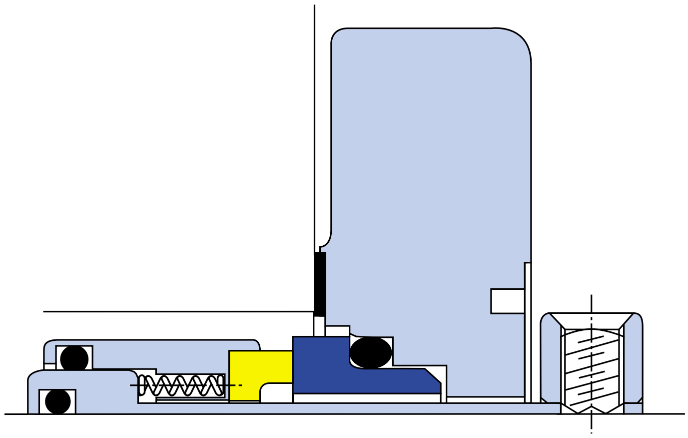
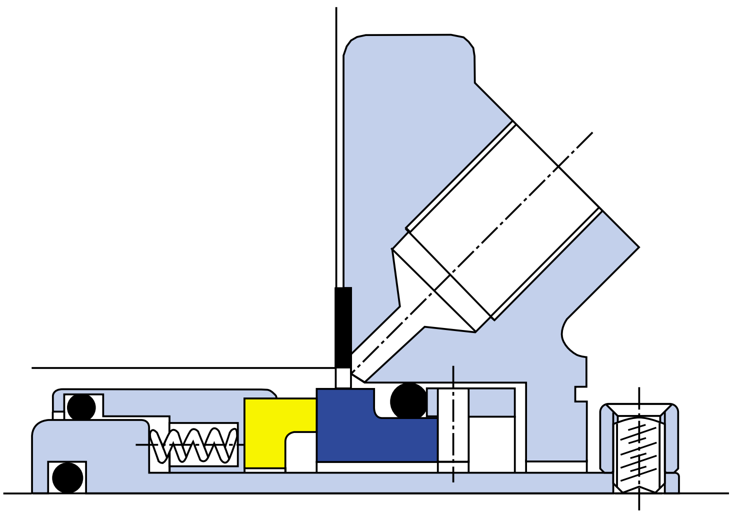
CONVERTOR II™



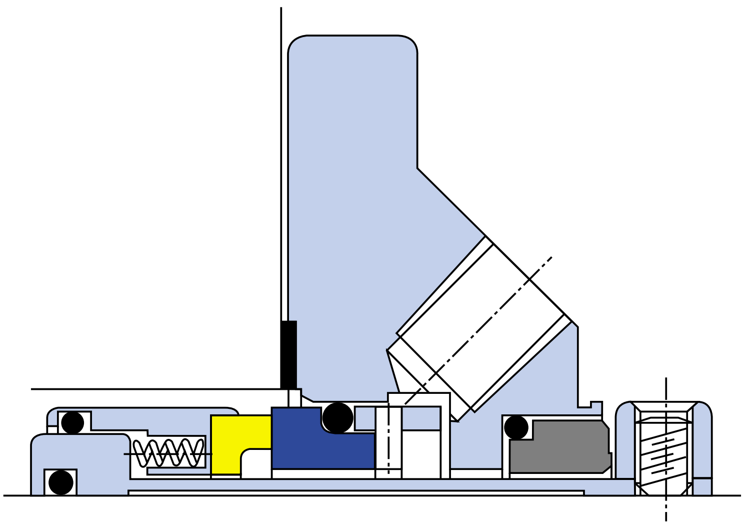
DRAWING 2.

SCUSI™



DRAWING 3.

CURC™



DRAWING 4.

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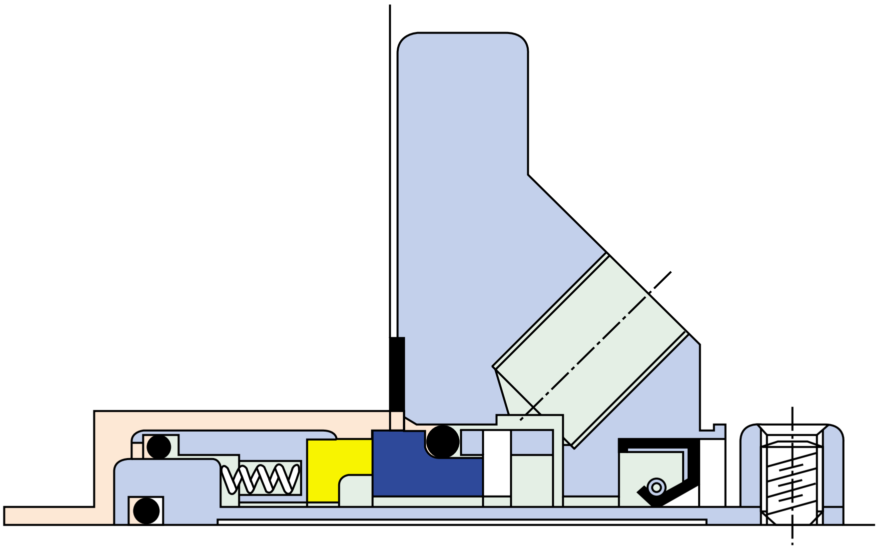
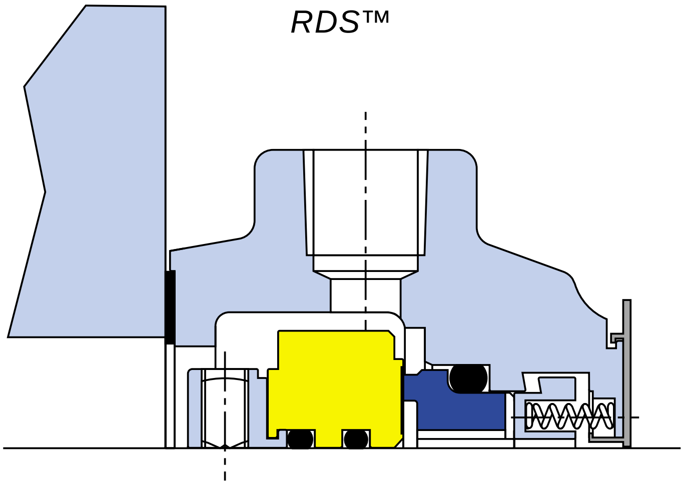
CRCO™



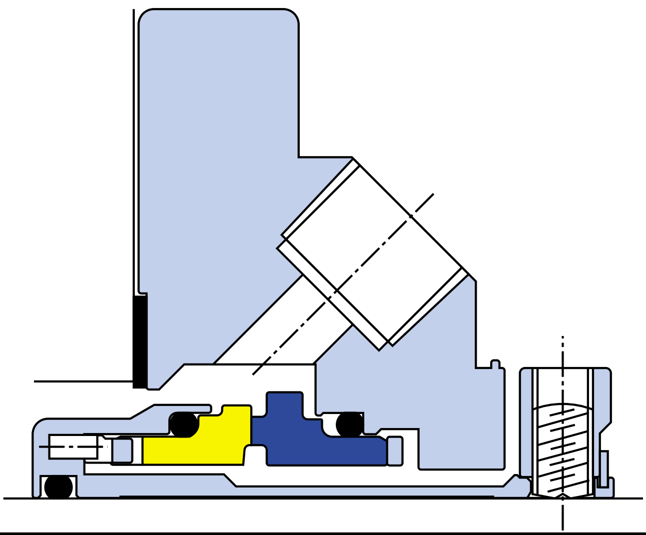
DRAWING 5.

RDS™



DRAWING 6.

SMSS™



DRAWING 7.

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Component Seals Usage

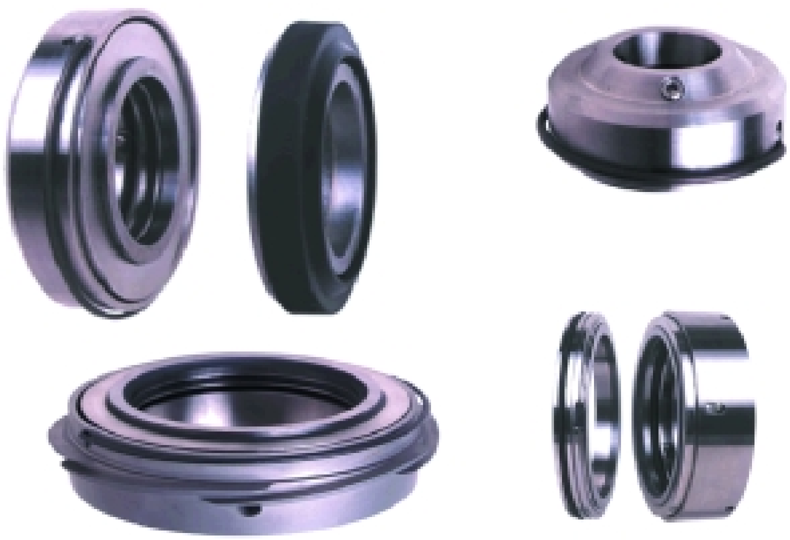
Component seals can be used in many applications throughout the industry, some of which are shown below.

Macerator Seals

BO6

Macerators are used in the sewage industry for breaking up large solids. The B06 is available in one size only (1.750”) and fits the Haigh® Macerator Groups 2, 3 and 4. Materials of construction are Carbon against Ni-Resist.

Submersible Pump Seals



The T05 range of seals are a direct replacement seal for ‘Flygt®’ pumps. It also offers a replacement seal both upper and lower for many of the Grindex® range of pumps.
As with many AESSEAL® designs modularity is a key feature. Some of the designs will fit up to eight separate pump models. The Component Seal brochure contains a list of pump types with the corresponding upper and lower seal. The Grindex® pumps are recognised by name.

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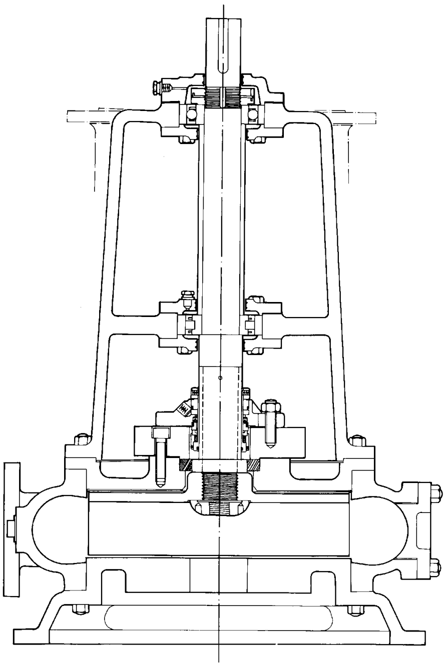
The AESSEAL® T05 Submersible Pump Seals (Alternative seals for Flygt® Pumps)

Stock Code	Size	Description	Suits Flygt® Pump Type
N-T05A-AEZ1-0200-U	20mm	Carbon Stainless Viton® - Upper Seal	2101 2066 2075 3080 Ready 24
N-T05A-GGZ1-0200-L	20mm	T/Carbide T/Carbide Viton® - Lower Seal	2101 2066 2075 3080 Ready 24
N-T05B-AEZ1-0280-U	28mm	Carbon Stainless Viton® - Upper Seal	3101
N-T05B-GGZ1-0280-L	28mm	T/Carbide T/Carbide Viton® - Lower Seal	3101
N-T05C-AEZ1-0220-U	22mm	Carbon Stainless Viton® - Upper Seal	2102-041 Ready 40 2071
N-T05C-GGZ1-0220-L	22mm	T/Carbide T/Carbide Viton® - Lower Seal	2102-041 Ready 40
N-T05E-AEZ1-0220-U	22mm	Carbon Stainless Viton® - Upper Seal	2102-040 3082
N-T05E-GGZ1-0220-L	22mm	T/Carbide T/Carbide Viton® - Lower Seal	2102-040 3082
N-T05F-GGZ1-0220-L	22mm	T/Carbide T/Carbide Viton® - Lower Seal	2071
N-T05G-AEZ1-0200-U	20mm	Carbon Stainless Viton® - Upper Seal	3067 3066 3085 3041 4400 4351 4352
N-T05G-GGZ1-0200-L	20mm	T/Carbide T/Carbide Viton® - Lower Seal	3067 3066 3085 3041
N-T05H-GGZ1-0200-L	20mm	T/Carbide T/Carbide Viton® - Lower Seal	4400 4351 4352
N-T05I-AEZ1-0280-U	28mm	Carbon Stainless Viton® - Upper Seal	2125-180 2125-181 2140
N-T05I-GGZ1-0280-L	28mm	T/Carbide T/Carbide Viton® - Lower Seal	2125-180 2125-181 2140
N-T05J-AEZ1-0250-U	25mm	Carbon Stainless Viton® - Upper Seal	3102
N-T05J-GGZ1-0250-L	25mm	T/Carbide T/Carbide Viton® - Lower Seal	3102
N-T05K-AEZ1-0350-U	35mm	Carbon Stainless Viton® - Upper Seal	2151-010 2151-011 2084 3126-180
N-T05K-GGZ1-0350-L	35mm	T/Carbide T/Carbide Viton - Lower Seal	2151-010 3126-180 2201-010
N-T05L-GGZ1-0350-L	35mm	T/Carbide T/Carbide Viton - Lower Seal	2151-011
N-T05M-AEZ1-0350-U	35mm	Carbon Stainless Viton® - Upper Seal	3127 4440 3126-181
N-T05M-GGZ1-0350-L	35mm	T/Carbide T/Carbide Viton® - Lower Seal	3127 4440 3126-181
N-T05N-AEZ1-0450-U	45mm	Carbon Stainless Viton® - Upper Seal	2201-010 2201-011
N-T05N-GGZ1-0450-L	45mm	T/Carbide T/Carbide Viton® - Lower Seal	2201-011 Grindex® Maxi
N-T05O-AEZ1-0450-U	45mm	Carbon Stainless Viton® - Upper Seal	3152 3140 Grindex® Maxi
N-T05O-GGZ1-0450-L	45mm	T/Carbide T/Carbide Viton® - Lower Seal	3152 3140 4501 4650 4660
N-T05P-AGZ1-0600-U	60mm	Carbon T/Carbide Viton® - Upper Seal	2250 3200
N-T05P-GGZ1-0600-L	60mm	T/Carbide T/Carbide Viton® - Lower Seal	2250 3200
N-T05Q-AGZ1-0600-U	60mm	Carbon T/Carbide Viton® - Upper Seal	3201 3170 600Prop
N-T05Q-GGZ1-0600-L	60mm	T/Carbide T/Carbide Viton® - Lower Seal	3201 3170 4410 4430 600Prop
N-T05R-GGZ1-0600-U	60mm	T/Carbide T/Carbide Viton® - Upper Seal	2400
N-T05R-GGZ1-0600-L	60mm	T/Carbide T/Carbide Viton® - Lower Seal	2400
N-T05S-GGZ1-0900-U	90mm	T/Carbide T/Carbide Viton® - Upper Seal	3300 680Prop 720 721 820 840 860 5560
N-T05S-GGZ1-0800-L	80mm	T/Carbide T/Carbide Viton® - Lower Seal	3300 680Prop 720 721 820 840 860 5560
N-T05Z-AEZ1-0250-U	25mm	Carbon Stainless Viton® - Upper Seal Grindex®	
N-T05Z-GGZ1-0240-L	24mm	T/Carbide T/Carbide Viton® - Lower Seal Grindex®	

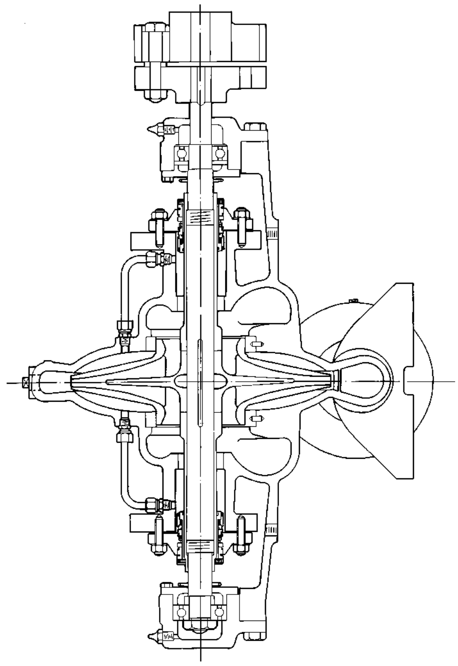
AESSEAL®
ENVIRONMENTAL TECHNOLOGY



DRAWING 7.

ADAMS VERTICAL PUMP SHOWING AESSEAL® CURC™ INSTALLED ON ADAPTOR PLATE

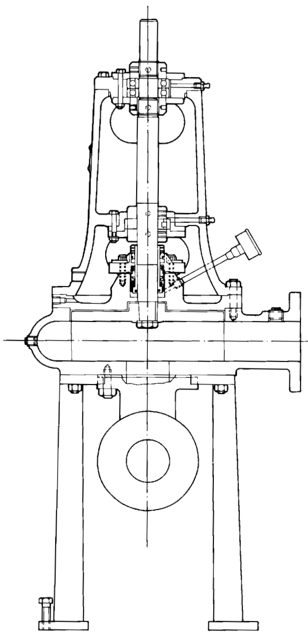
Drawing by courtesy of ADAMS HYDRAULICS Ltd.



DRAWING 9.

WORTHINGTON SIMPSON "L" TYPE PUMP SHOWING AESSEAL® CURC™ SEALS INSTALLED

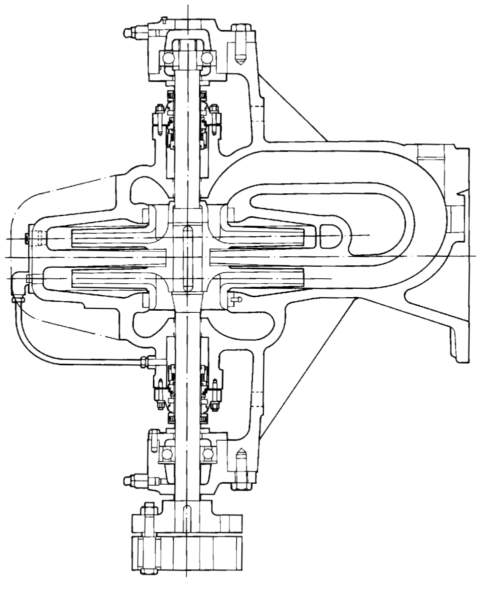
Drawing by courtesy of DRESSER PUMPS.



DRAWING 8.

WALLWIN 1094 SHOWING AESSEAL® CURC™ INSTALLED

Drawing by courtesy of BIWATER PUMPS.

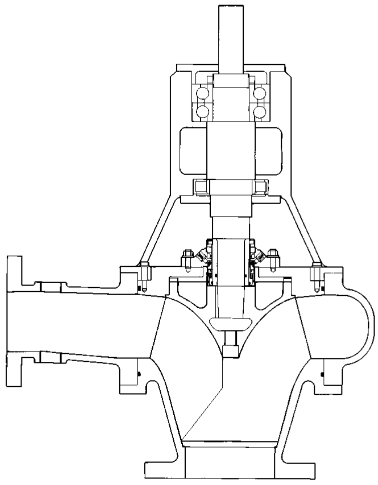


DRAWING 10.

WORTHINGTON SIMPSON "U" TYPE SHOWING AESSEAL® CURC™ SEALS INSTALLED

Drawing by courtesy of DRESSER PUMPS.

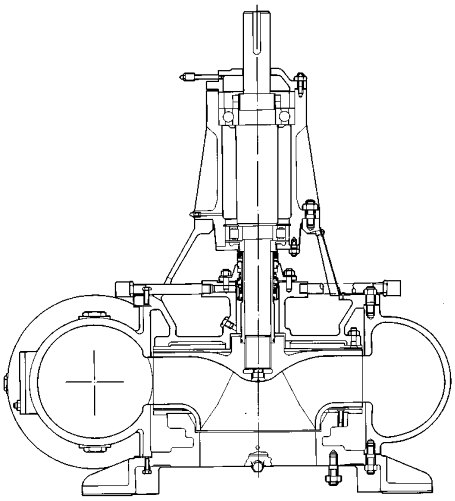
ENVIRONMENTAL TECHNOLOGY



DRAWING 11.

SPP FREESTREAM SHOWING AESSEAL® CRCO™ SEALS INSTALLED

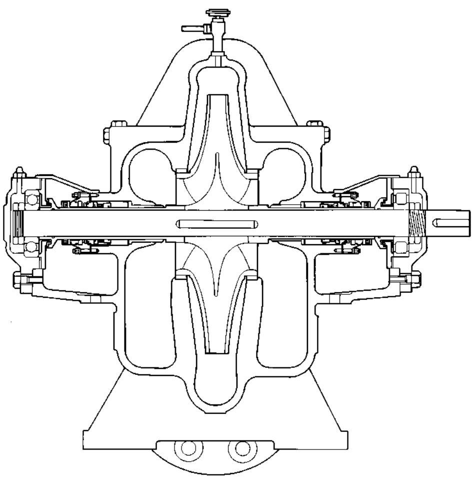
Drawing by courtesy of SPP Ltd. Reading England.



DRAWING 12.

SPP ED12 SHOWING AESSEAL® CURC™ INSTALLED

Drawing by courtesy of SPP Ltd. Reading England.



DRAWING 13.

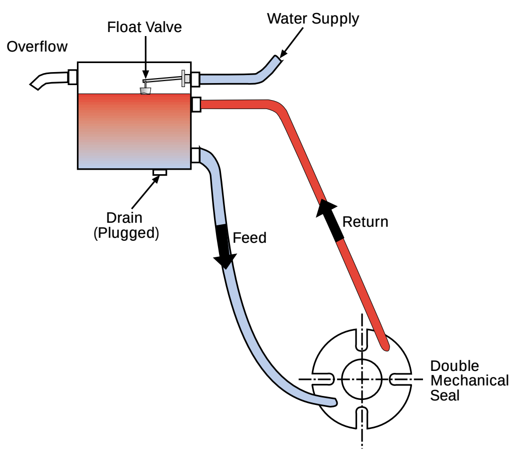
WEIR UNIGLIDE SHOWING AESSEAL® CURC™ SEALS INSTALLED

Drawing by courtesy of WEIR PUMPS Ltd.

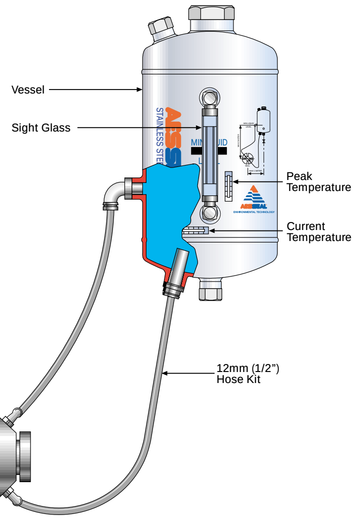
AESSEAL® ENVIRONMENTAL TECHNOLOGY

WATER & WASTE

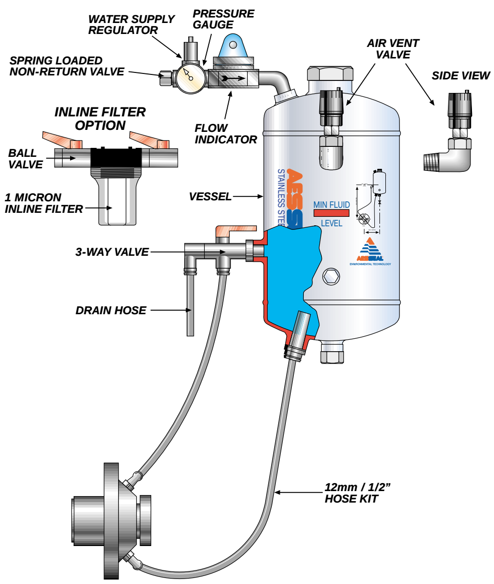
System Selection



a. Buffer Reservoir



b. P1 System



c. W2 System

Where the application has dictated the selection of either a CRCO™ or a CURE™ seal these are best supported by one of the following non-pressurized systems:

a. The Buffer Reservoir™ is an atmospheric, automatically replenishing water system.

b. The P1 system which is an atmospheric, manually replenishable water system.

Where a CDSA™ has been selected, the recommended system selection should be:

c. The W2 system which is pressurized, automatically replenishing water management system.

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SAI™ / USI™	114, 162, 163, 1299, 1300, 1317
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CURC™	016, 017, 112, 113, 114, 115, 119, 276, 321, 323, 324, 1295, 1300, 1319, 1320, 1321, 1322, 1324, 1325, 1326, 1327, 1328, 1329
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CRCO™	018, 164, 279
B06™	1302
RDS™	1298
SCUSI™	1323

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Final Effulent	1317
River Water	1304
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Sewage Sludge	321, 279

AESSEAL® ENVIRONMENTAL TECHNOLOGY

1329K – "3 seals in raw sewage with at least 9 years life and two of them are still running."

In a pumping station situated on the outskirts of Thetford in Norfolk and containing three Lee Howl 6x6 non-clog vertical spindle pumps handling raw sewage.

The AESSEAL® branch in Peterborough converted these three pumps to 2.625" CURC™ cartridge seals with carbon vs chrome oxide faces and viton elastomers in late 1991/early 1992.

The first seal has just recently failed (2001) and has been replaced with a CURC™ of identical materials.

The remaining two seals are running leakfree, so there may have been an operational problem with this one unit.

1328K – "14 years average life in raw sewage."

In a sewage pumping station not far from Beccles in Suffolk,UK, two vertical spindle SPP type EDO3C pumps running at 1450 rpm were converted in November and December 1987 by the AESSEAL® branch in Peterborough to 2.625" CURC™ cartridge seals.
Seals had carbon vs chrome oxide faces with viton elastomers to handle raw sewage.

The outside diameter of the glands was reduced to 6.5" in order to pass through the bearing housing aperture.

The first seal failed in 2001 and was replaced with a CURC™ with the same material specification. The second has began to leak in October 2001, but almost 14 years life should be excellent value for money.

1327K – "9.5 years average life in raw sewage."

In 1990, 2 AESSEAL® 2.250" CURC™ seals with Carbon/Chrome Oxide faces were installed on Pegson 6/15 pumps at a water company to seal sewage. They used Carbon/Chrome Oxide faces and worked well until they were changed in 1999.

1326K – "7 years average life in raw sewage."

In 1992, 2 AESSEAL® 2.000" CURC™ seals with Carbon/Chrome Oxide faces were installed on SPP - SBVC 4/8 pumps at a water company to seal sewage. They used Carbon/Chrome Oxide faces and worked well until they were changed in 1999.

1325K – "9.5 years average life in raw sewage."

In 1990, 2 AESSEAL® 3.125" CURC™ seals with Carbon/Chrome Oxide faces were installed on Adams 6L RH pumps at a water company to seal sewage. They used Carbon/Chrome Oxide faces and worked well until they were changed in 1999.

1322K – "6 years average life in raw sewage."

Over 50 AESSEAL® CURC™ seals (1.500" -3.250") were fitted to Adams/Walwin pumps at a water supplier in Teeside in 1987. These all lasted over 6 years each and were used to seal sewage. Faces used were Carbon/Chrome
Oxide.

1321K – "7 years average life in raw sewage."

12 AESSEAL® CURC™ seals (2.000" - 2.250") were fitted to Weir pumps at a water supplier in Teeside in 1989.These all lasted over 7 years each and were used to seal sewage. Faces used were Carbon/Chrome Oxide.

1320K – "9 years average life in raw sewage."

Over 60 AESSEAL® CURC™ seals (1.500" - 6.000") were fitted to Lee Howl Sulzer and other manufacturers pumps at a water supplier in Teeside in 1987. These lasted on average 9 years each and were used to seal sewage. Faces used were Carbon/Chrome Oxide.

1319K – "10 year life on treated water and still operating."

In November 1991 2 x 2.75" Dia. CURC™ Car / Crox / V. were fitted to a Mather & Platt 7" / 9" GMBB Pump to replace gland-packing on a pump handling treated water. Extended threaded sleeve-nuts were made to provide the extra parallel sleeve diameter required to accommodate the clamping screws on the cartridge-seal. The pumps run intermittantly with the original seals in place after ten years.

1318K – "11 year life in Final Effluent."

SPP / FEW-16 Pumps using an obsolete seal type were fitted with 3.500"Dia. SE Rotaries and USL Stationaries Car / Crox / V. in 1989. The pumped medium is final effluent so did not require a sophisticated seal arrangement. An adaptor plate is used to locate the stationary seal-face onto the pump-casing and the seal is located on the parallel shaft below the bottom bearing. The seal showed signs of leakage in year 2000 and was replaced with the current seal-design which is the NCE™ Rotary v NSI™ Stationary.

AESSEAL® ENVIRONMENTAL TECHNOLOGY

1317K – "11 year life in treated water before the pump bearing failed."

A private Water Company fitted 2 x 2" Dia.SAI Car / V & U.S.L.Stationary Crox/V. to a horizontally-split case pump in 1987 handling treated water. They replaced single-spring seals that gave satisfactory life but were difficult to install. In 1998 the bearings needed to be replaced so the pump was stripped down. The seals had not been leaking and we were able to refurbish the seals and reinstall them.

1304J

In a Power Station 285mm CURC™ seals with Carbon and Chrome Oxide faces and Viton® Elasomers (API Plan 13) were installed on Mather and Platt split case pumps. The original sleeve size was 12" and this was machined to 285mm. The pumps size was 72" X 72" and used to pump river water to cooling towers. Pressure was 30 psi and it pumped 1,000,000+ gallons per hour. The first two seals, 285mm CURC's carbon/chrome oxide, viton®, were fitted August 1997, eight more seals were fitted to four pumps over the next two years. All seals are still running and no maintenance was required.

1302J

Haigh® Macerators are to be found in operation by many wastewater treatment plants and the AESSEAL® B06 is entirely suitable for use on this equipment.

1301J

The AESSEAL® seals suitable for use on Hidrostal pumps have been successfully applied by a water authority for pumps handling raw sewage. No modifications were required to the pump, the seals were readily available and the lower seal can be refurbished at the end of its useful life.

1300J

Vickers Screens used a very simple sprung seal face, which did not work well. AESSEAL® applied an 85mm diameter SAI™ CAR/V (width 135mm) versus CURC™ stationary face in an adaptor plate which since it was fitted in 1997 has never leaked. The seal is positioned at the bottom of an archemedes screw and protects the gear box from wastewater and solids. Six screens were converted and large savings in plant down time have been realised.

1299J

Jones & Attwood Washpactors used a competitors seal which was to DIN standards. AESSEAL® supplied 60mm diameter SAI™ TC/V and DIN SiC stationary. This is an extremely arduous application and although seal life has only improved marginally AESSEAL® offered seals on ex-stock delivery, lower cost and a repair programme. Since 1998 over 100 sets of seals have been supplied to one major UK water authority and 20 sets have been repaired.

CASE: 1298J

Sulzer pump type NPV 146 handling raw water at 333 rpm and 21 metres head used cone shape split seal faces which gave unreliable seal life. Every time the seal faces need to be changed the adjacent pipework took two days to drain down because plant safety would not allow the isolating valves to be the only barrier between the pump and the reservoir. During pump overhaul RDS™ x 9.625" diameter was installed and despite some initial leakage is now sealing satisfactorily. The RDS™ is expected to give more reliable life and future pumps will be fitted with an AESSEAL® shutdown seal which will isolate the seal from the pipework.

CASE: 1297J

Adams pumps using the impeller boss as the gland packing location have been converted to AESSEAL® seals by machining the tapered shaft parallel above the boss and installing NCE™ rotary versus NSI™ stationary using simple adaptor plates. Seal diameters vary between 70 and 80mm depending on the size of the pump. This method of seal conversion has been used on a high number of pumps since 1996 and has proved to be an economical way to install seals on these heavy duty pumps.

CASE: 1296J

Three Wallwin pumps using single spring seals, which were difficult to fit and gave unreliable seal life, were converted to the use of Convertor II™ x 50mm diameter. An L-section adaptor ring was used and these seals have run satisfactorily since November 1998. Pumps rotate at 1450 rpm handling raw water.

CASE: 1295J

An SPP FEW split case pump rotating at 1450 rpm in a water treatment and supply plant using cone shape split seal faces had seal leakage three times within the life of the pump bearings. This inevitably caused water pollution to the bearings reducing their life. Two CURC™ 105mm diameter with specially made gland plates with three bolt holes to suit the pump were supplied and fitted in February 1998 and have run leak free. No modifications were required to the pump. The availability and price of the CURC™ was competitive with the seal that it replaced.

CASE: 1324I – "8 years average life in raw sewage – still running in December 2000 when last checked."

Two AESSEAL® 35mm CURC™ mechanical seals with Carbon/Chrome Oxide faces were installed on New Hayden pumps in 1992. They were used to seal sewage at a water company and were still running in 2000.

CASE: 1323I – "8 years average life in raw sewage – still running in December 2000 when last checked."

Two AESSEAL® 1.500" SCUSI™ mechanical seals with Carbon/Chrome Oxide faces were installed on Harland pumps in 1992. They were used to seal sewage at a water company and were still running in 2000.

CASE: 763H

In a Chemical Plant, Weir Uniglide SDB 10/12 pumps running at 2900 rpm were fitted with a 3.000 Convertor II™, C/CRO2/Viton® seals. The pump needed a new sleeve fitting along with a new bearing - damage caused by packing. The pumps were sea water Boosters.

CASE: 324D

In a Sewage Treatment Works, 130mm CURC™ seals with Solid Tungsten Carbide faces and Viton® 'O' rings were installed to Warman International 6/4 pumps. The pumps rotate at variable speed and transfer Sewage Sludge via five pumping stations along a 30 mile pipeline. Six pumps are employed in each pumping station. The normal operating pressure is 16 barg (240 p.s.i.g), however the pressure can peak at 22 bar g (330 psig). The temperature is ambient. The pumps were installed with the seals fitted in 1988 and the seals give an average life of 2 to 2 1/2 years. A water flush is utilized, 1 bar above the stuffing box pressure.

No modifications to the pumps were required.

CASE: 323D

In a Reservoir Water Treatment Plant, 110mm CURC™ seals with Carbon / Chrome Oxide faces and Viton® 'O' rings were installed to Sulzer BAP2 pumps. These pumps rotate at 985 rpm and supply Treated Water to the consumer grid. The product temperature is ambient and the pressure 120 psig (8 barg) maximum. The pumps were previously packed using a Graphite / Asbestos packing and sleeve wear was evident. Constant attention was required to control the leak. The CURC™ seals were installed in November 1989 and are working leak free.

No modifications were required.

CASE: 321D

In a Sewage Works, 2.000" CURC™ seals with Solid Tungsten Carbide faces and Viton® 'O' rings were installed to Biwater 4SHLH pumps. The pumps rotate at 970 rpm and transfer sewage sludge with a high grit content from the Primary Settling Tanks to the Macerators. The product temperature is ambient and the pressure is 60 psig (4 barg). The pumps were previously packed using Graphite/Asbestos packing and the gallery in which they are installed was always wet with sewage sludge and needed hosing down frequently. The installation of CURC™ seals completely sealed the pumps and kept the gallery dry. The seals were installed in 1988 and gave a 2 1/2" year seal life with Carbon / Chrome Oxide faces. The seals have since been replaced with Solid Tungsten Carbide faced seals which have been running 2 years leak free.

No modifications were required.

CASE: 279C

In a Water Company 45mm CRCO™ seals with Solid Tungsten Carbide faces and Viton® 'O' rings were installed to Netzsch NE40 Peregrine Cavity pumps. The pumps rotate at 1,000 rpm and transfer Sewage sludge in a Treatment Plant. The product temperature is 15°C (60°F) and 3 barg (45 psig) pressure. The pumps were previously packed and leaked constantly causing a housekeeping problem and sleeve wear.

The seals were installed in December 1988 and are still working leak free. The barrier fluid is supplied by two open-topped tubes connected to the seal, filled with oil. An adaptor plate was made to mount the seal to the stuffing box.

CASE: 276C

In a Sewage Plant, 55mm CURC™ seals with Solid Tungsten Carbide faces and Viton® 'O' rings were installed to KSB KRP 100-250 pumps. The pumps rotate at 1,450 rpm and pump an extremely abrasive sand and sewage slurry. The product is at ambient temperature and 4 barg (60 psig) pressure. The pumps were previously packed using an arramid fibres which leaked constantly and caused shaft wear and housekeeping problems. The CURC™ seals were installed in 1987 and gave two years working life. No modifications were required.

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CASE: 163C

In the same Council's area, 2.375" SAI™/USI™ seals, with Carbon/Chrome Oxide faces and Viton® 'O' rings were installed to Adams 5M Amphistoma pumps on the same Sewage Transfer duty as Case 162.

These seals were installed in June 1985 and are still working well. The split packing stuffing box was removed and a new seal housing fitted. The shaft and sleeve are machined to remove the packing scores and also the step on the shaft. This makes it a constant diameter. A restriction bearing bush is then fitted to the bottom of the back plate to form a stuffing box bottom and give stability to the shaft.

CASE: 162C

In a Council Sewage Plant, 3.500" SAI™/USI™ seals, with Carbon/Chrome Oxide faces and Viton® 'O' rings, were installed to Lee Howl 8 X 10 6020m/44301L pumps. The units rotate at 960 rpm and pump Storm Water and Sewage to the Treatment Works. The product temperature is ambient and the pressure 50ft/hd. The pumps were previously packed using PTFE/Asbestos packing and this required constant attention. The seals were installed in September 1985 and are still working well.

No modification was required.

CASE: 018C

On a Sewage Treatment Plant, a 2.500" CRCO™, with a standard face combination and Viton® 'O' rings, was installed in a Sulzer Disintegrator D12, rotating at 415 rpm. These units reduce the size of the solids in Decanted Raw Sludge by chopping it with rotating blades. The design is such that an oil seal is placed between the impeller and the bearings, followed by a stuffing box with packing in it. The packing, therefore, seals the lubrication into the bearings, but the oil seal soon leaks and the bearing either runs in sewage or completely dry. The CRCO™ AESSEAL® with a five gallon drum oil container fitted with Hydraulic Oil, was installed as an experiment in August 1988 and is still working well. Five more have been fitted since. This solution will stop all shaft wear and end the possibility of the sealing member running dry.

CASE: 017C

On a Sewage Treatment Plant, 1.500" CURC™ seals, with Solid Tungsten Carbide faces and Viton® 'O' rings, were fitted to Wallwin 1094713R/H pumps, rotating at 950 rpm. These pumps handle Screened Sludge at 36°C (97°F) and a pressure of 12 barg (180 psig). The original single spring seal lasted from several weeks to a few months before clogging of the spring was experienced and clogging of a bypass line to supply fluid to the seal took place. The replacement seal supplied was found to be difficult to install and this led to further failure. The CURC™ seals were an easy to install replacement. Fitted in March 1986 they gave a three year life. The stuffing box bore was opened up to accept the seal and an adaptor plate was fitted to the face of the stuffing box.

CASE: 164B

In the Council's area, 2.375" CRCO™ seals, fitted with Carbon/Chrome Oxide faces and Viton® 'O' rings were installed to Adams Amphistoma 5L pumps. These pumps were also on the same duty and required the same modification as those in 163. The seals were fitted in December 1987 and the CRCO™ oil barrier fluid is connected to pressure sensing equipment which notifies the central computer of sudden increases in pressure and possible seal failure. This telemetry system is now being used to aid in seal failure forecasting.

CASE: 119B

Lee Howl 6 X 8 pumps rotating at 1,450 rpm in Raw Sewage at ambient temperature and a pressure of 20ft/hd. The pumps were packed with Asbestos/Graphite packing which failed to control leakage into the bearing area and also caused shaft sleeve wear. The pumps examined were fitted with CURC™ seals in July 1987 and are still working well. The seals fitted were 2.250" CURC™ with Carbon/Chrome Oxide faces and Viton® 'O' rings. New sleeves were installed with 2.250" outside diameter.

CASE: 115B

SSP SBV pumps rotating at 970 rpm on Raw Sewage at ambient temperature and a pressure of 20ft/hd, were packed with various materials which all failed to control leakage and allowed water into the bearings and thus caused shaft sleeve wear. The pumps examined were fitted with an AESSEAL® CURC™ in June 1985 and are still working well. The seal is a 3.500" CURC™ with Carbon/Chrome Oxide faces and Viton® 'O' rings. A brass bushing was fitted to the bottom of the stuffing box to give the shaft bearing support and the face of the stuffing box was machined to ensure a good gasket seal.

No modifications were required.

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ENVIRONMENTAL TECHNOLOGY

CASE: 114B

An SPP FEW pump, rotating at 1,450 rpm on Raw Sewage at ambient temperature and a pressure of 20 ft/hd, was packed with various materials which all failed to stop excessive leakage and water entering the bearings and shaft sleeve wear.

The pumps examined were fitted with CURC™ or SAI™/USI™ seals in December 1985 and are still working well. The seal was either an AESSEAL® 3.875" CURC™ or SAI™/USI™ with Carbon/Chrome Oxide faces and Viton® 'O' rings. A tapered sleeve is machined to the bearing diameter and a brass sleeve is then shrink-fitted to it, then the impeller fitted. These components are then machined to 3.875" diameter. This removes the packing wear from the impeller base. A brass bush is then fitted into the bottom of the stuffing box which offers bearing support and restriction bushing. An adaptor plate is then locked to the face of the stuffing box to eliminate the pump three bolt gland fastening. This is drilled and tapped with two studs to suit the seal. The diameter of the plate is as per a 3.875" CURC™. The plate also raises the seal closer to the bearings and allows room to widen the brass support as described earlier.

CASE: 113B

An Adams SXL pump, rotating at 1450 rpm on Raw Sewage at ambient temperature and pressure of 20ft/hd, was packed with Graphite/Asbestos packing which was continuously leaking water into the bearings causing shaft sleeve wear. The pump examined was fitted with a CURC™ seal in January 1986 and the seal is still working well. The seal is a 2.500" CURC™, fitted with Carbon/Chrome Oxide faces and Viton® 'O' rings. A replacement stuffing box is manufactured to house the seal. This replaces the split packing box. The sleeve and shaft are machined to remove the packing scores and also the step on the shaft to make it a constant diameter. A restriction bearing bushing is then fitted into the bottom of the back plate by press fitting and re-machining. This forms a stuffing box bottom and gives good stability to the shaft.

CASE: 112B

In the Water Authorities, AESSEAL® seals have been used very successfully to eliminate leakage on many types of pumps. Hundreds have been converted in the way specified. A Wallwin 1094, rotating at 1,450 rpm on Raw Sewage at ambient temperature and pressure of 20ft/hd, was packed with Graphite/Asbestos packing which leaked continually, allowing water into the bearings and causing shaft wear. The pump examined had a CURC™ seal fitted in November 1987, and this will be expected to run leak free for years to come. The seal is an AESSEAL®. 1.500" CURC™ with Carbon/Chrome Oxide faces and Viton® 'O' rings. The modifications were to turn the old worn sleeve and the corroded shaft above the stuffing box to a diameter of 1.250". We then had to shrink on a new brass sleeve and turn down to 1.500" on the shaft, ensuring a clearance of approximately 0.030" between the top of the shaft taper and the end of the new sleeve to enable the impeller to be locked. We bored out the stuffing box to the maximum allowed with a 1.500" CURC™ and drilled and tapped for 2 x 3/8" cap head screws to fit the seals.

CASE: 016B

On a Sewage Treatment Plant, AESSEAL® 3.000" CURC™ with Solid Tungsten Carbide faces and Viton® 'O' rings, were fitted to Lee Howl 507LP5 pumps, running at 1,450 rpm. These pumps circulate Raw Sludge through a heat exchanger to increase its temperature and aid in bacteriological breakdown. The product temperature is 50°C (120°F) and the pressure 7 barg (105 psig). These originally packed pumps were tried on many makes and materials of packing, but nothing would work. The pumps were taken by AESSEAL® to their Derby Workshop for an overhaul and seal fitting. This was carried out in May 1987 and the seals worked satisfactorily until the system was changed during 1989.

No modification was required.

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ENVIRONMENTAL TECHNOLOGY

NOTE:

Due to AESSEAL's policy of continuous improvement the following seal types have been upgraded:

SCI	*upgraded to*	*SCUSI*
CSAI	*upgraded to*	*CURC*
CAPI	*upgraded to*	*CURC*
CAPO	*upgraded to*	*CRCO*
CMDS	*upgraded to*	*CDSA & DMSF*

The original products evolved into more modern seals which were designed to enhance application performance. The product model reference in the case study is for the most modern design, even though at the time of installation the actual installation was the predecessor model.

All information featured in these case histories has been obtained directly from Plant Engineers.

Although we have confidence in the accuracy of this information, it is not offered as a guarantee for seals manufactured by AESSEAL®

Any prospective user of our product should verify the information stated to their own satisfaction.

Further information is available on all the case histories contained in this booklet upon request.

Issue 'B' on a case history refers to information which was current on the 31st. January, 1990.

Issue 'C' refers to information which was current on 31st. January, 1991.

Issue 'D' refers to information which was current on 31st. January, 1992.

Issue 'E' refers to information which was current on 31st. January, 1993.

Issue 'F' refers to information which was current on 31st. January, 1995.

Issue 'G' refers to information which was current on 31st. January, 1998.

Issue 'H' refers to information which was current on 31st. October, 1999.

Issue 'I' refers to information which was current on 31st. March, 2000.

Issue 'J' refers to information which was current on 31st. November, 2000.

Issue 'K' refers to information which was current on 31st. November, 2001.

Where the statement 'The seals are still working' is made, this means that the customer is or was still using AESSEAL® mechanical seals at the time the case history was updated; as denoted by either:
Issue 'B', Issue 'C', Issue 'D', Issue 'E', Issue 'F', Issue 'G', Issue 'H', Issue 'I', Issue 'J' or Issue 'K'.

For more detailed information, please contact our Applications Department.

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THE QUEEN'S AWARDS FOR ENTERPRISE 2000

INVESTOR IN PEOPLE

USE DOUBLE MECHANICAL SEALS WITH HAZARDOUS PRODUCTS. ALWAYS TAKE SAFETY PRECAUTIONS:

- **GUARD YOUR EQUIPMENT**
- **WEAR PROTECTIVE CLOTHING**

WARNING

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