ENVIRONMENTAL TECHNOLOGY

A Guide to Sealing

OIL SEED PROCESSING PLANTS

- OIL SEED PRODUCT
- OIL SEED USAGE
- PRODUCTION PROCESS
- REFINING PROCESS
- MECHANICAL SEAL SELECTION
- CASE HISTORIES

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ACKNOWLEDGMENT

AESSEAL plc wishes to acknowledge the following sources of information and data used in compiling this publication:
American Soybean Association & American Oil Chemist Society.

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Introduction

Oil Seed Processing has become a major industry through out the World Economy as Food Producers continue to develop more uses for these Edible Oils. Oil can be derived from such seeds as Corn, Soybean, Cotton, Canola, Peanut, Sunflower.

There are approximately 272 Million MT (metric tons) of Oilseeds produced annually in the world and of this production over half the oilseeds grown are soybeans and 74 Million MT of Soybeans are produced per year in the United States. Within the last few years, the emphasis of the Oilseed Oil Producer has changed from stand-alone independent operations toward the integrated manufacturing facility, producing a more complete range of value-added products from the raw seed to the dinner table. End products such as Salad Oil, Shortening, Mayonnaise, and Margarine are commonly produced from these process plants.

Modern Oil Seed Processing consists of a series of unit processes that take the seed through the following steps:

1) Drying
2) Cleaning, Cracking, Dehulling
3) Conditioning and Flaking
4) Solvent Extraction and Solvent Removal
5) Degumming
6) Alkali-Refining
7) Bleaching
8) Hydrogenation
9) Deodorizing
10) Blending and Storage

Safety & Environmental Issues

Typical industry safety procedures are adhered to in most of these type plants. Care should be taken to wear safety glasses at all times and proper ear, head and foot protection is recommended.

In the Extraction area of the plant where Hexane is present, care should be taken to eliminate any items that may cause a spark, which can result in a flash fire due to the highly flammable nature of this solvent.

Other areas of these plants may have steam present for product heating. In the Refinery care should be taken when moving around the plant as some of the floors can be slippery due to product leakage and caustic cleaning procedures. While in the packaging areas where food grade material is present, hairnets may also be required.

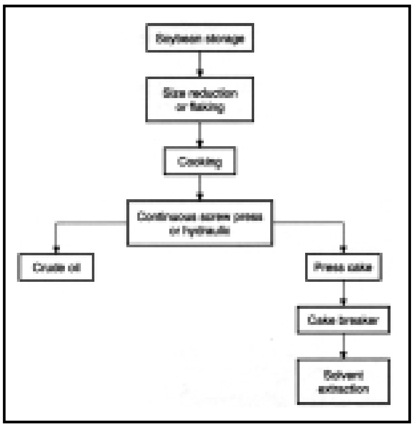
A General Overview of the Process

Dry End

Seeds are harvested and brought to the plant via rail or truck and transferred to the storage silos via mechanical and/or air assisted elevators. The seeds are then moved to the cleaning process via mechanical augers and conveyors where any field trash is removed. The seeds are dried to the desired moisture content of 12% and then tempered which causes the husk to pull away from the meat and prepares the product for cracking and dehulling. The seeds are then weighed into the rotary cracking equipment. The objective of cracking is to break the seeds into suitable pieces for dehulling and flaking. The cracking is accomplished by passing the product through corrugated sawtooth opposing rolls running at varying speeds. The seeds now pass to either the vibratory screens, cyclone separators, or vacuum separator (Kice Separator) where they are subjected to up flows of dry air and the hull (husk) and meat (beans) of the seeds are separated. Cyclone Separators are utilized to remove the fine particles and trash from the hulls and collected in the bag house. The hulls are then sent to a secondary dehulling process, which separates the hulls into sizes for processing into meal and feed stock. Blowers and Vacuum units are used in this area to convey both materials to the next phase of the operation.

Conditioning

The beans or meat are then passed through a steam heating process. This is accomplished by either a vertical stack cooker or rotary horizontal cookers where the cracks are heated to approximately 72ºC (161ºF) and steam, or a water spray, is added to adjust moisture to approximately 11%, which makes the material plastic for flaking. On these types of cookers there are rotary steam joints (Johnson is typical) which require sealing.



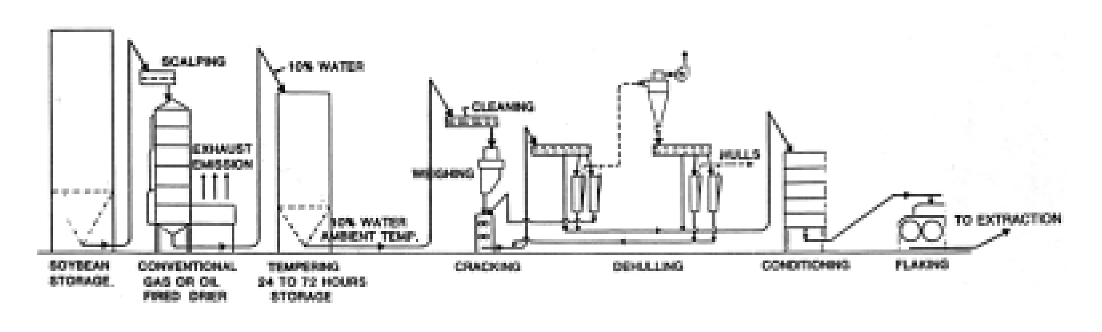
Conditioning Processing Schematic.

Conditioning and Expanding

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Steam Joints	Steam	177ºC (350ºF)	SNOZ™	316L	CB/TC	Aflas®		
Expander Extruder	Seed Flake	71ºC (160ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Water	Water	Ambient	CURC™	316L	CB/TC	Aflas®	11	

Flaking

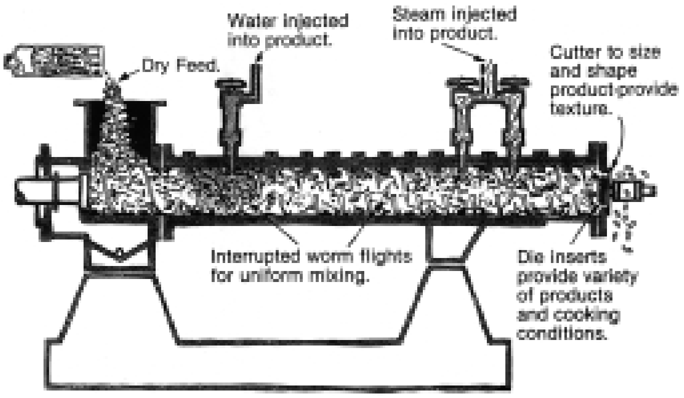
Flaking mills consist of a pair of smooth-surfaced rolls of approximately 20 to 32 inches (508mm to 812.8mm) in diameter which operate in opposing directions with minimum clearance and driven at different speeds. Pressure between the rolls is generated by mechanical or hydraulic systems and flake thickness is controlled by adjustments of this pressure. Flake thickness is generally in the range of 0.005 to 0.020 inches (0.13mm to 0.5mm).



Conventional preparation system.

Expanding (optional)

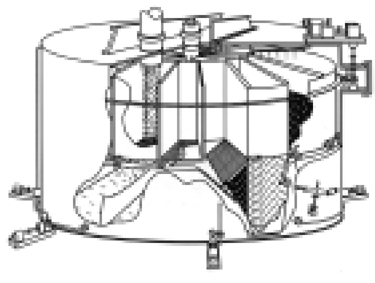
The dry flake is then transferred to the Expanders (extruders) where water and steam is introduced into the product and mixed in the chambers of the extruder. The wet cake is then extruded from the expander at approximately 104ºC (220ºF), sized and cut via a die head to provide the optimum material for the extraction phase of the process. These extruders require shaft sealing on the drive end where the shafts tend to operate at slow speeds but with high pressures and solids content in the extruder chamber. The expander process is used when increased bed drainage is desired in the Extraction Process, mainly in deep bed or Rotocel extraction.



The Expander Collets are discharged through die openings.

Extraction

Solvent extraction of oilseeds is a diffusion operation in which the solvent (Hexane) selectively dissolves miscible components (oil) from other substances. The extractor unit provides the physical means of contact between the solvent and solids consisting of prepared oilseeds. Immersion and Percolation are the most common types of extraction though Percolation extraction is more common in modern process plants.



Rotacel rotary extractor.

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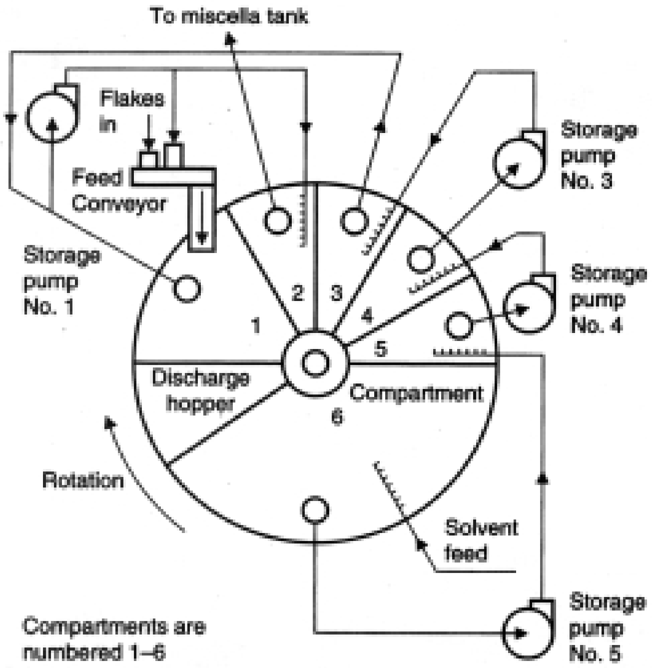
The Percolation method utilizes a bed composed of oilseed flakes and countercurrent flow of the flakes and miscella (the mixture of oil and Hexane). Three types of extractors are commonly found in the industry: 1) Rotary or Deep Bed, 2) Horizontal Belt, 3) Continuous Loop. A large percentage of the modern process plants utilize the Horizontal Continuous Loop though some of the older facilities still rely on the Rotary or Deep Bed technology.



Schematic diagram of rotary extractor.

The Horizontal Continuous Loop units utilize a conveyor system which moves the miscella through different stages of solvent introduction and screening, and finally a product dump cell. The Rotary Deep Bed units consist of a series of concentrically arranged cells, which are filled with oil-bearing material. Each cell is filled consecutively and brought in contact with decreasingly concentrated miscella. The freshly charged solids are brought into contact first with the most concentrated miscella and the fully extracted solids contact fresh solvent before discharging. Sealing of the rotating shaft on both top and bottom has historically been accomplished with mechanical packing, air energized boot or lip seals. Non metal contacting seals are preferred in this area due to the presence of Hexane in the process (which is extremely volatile in its common state) and the desire to minimize any sparking due to metal to metal contact or heat generation.

Solvent Removal and Recovery

The spent Hexane solvent must be recovered and recycled with a minimum of loss. Solvent leaves the extractor as full miscella and as solvent in the flakes, and is then transported to desolventizing. Solvent is removed from the Miscella by double-effect evaporation and steam stripping via a rising film evaporation process. In the first effect evaporator the mixture is 80% oil and the mixture is heated to approximately 38ºC (100ºF). In the second effect evaporator the mixture is heated with 182ºC (360ºF) steam to drive the Hexane out and leave a mixture of 98% oil at 110ºC (230ºF). The miscella is then contacted directly by steam in the primary stripping operation and the Hexane is again driven off leaving 99.5% oil. In the secondary stripping process, steam is again injected into the miscella and the final 99.9% pure oil product is produced. Producers strive for less than 100ppm of Hexane in their pure oil products.

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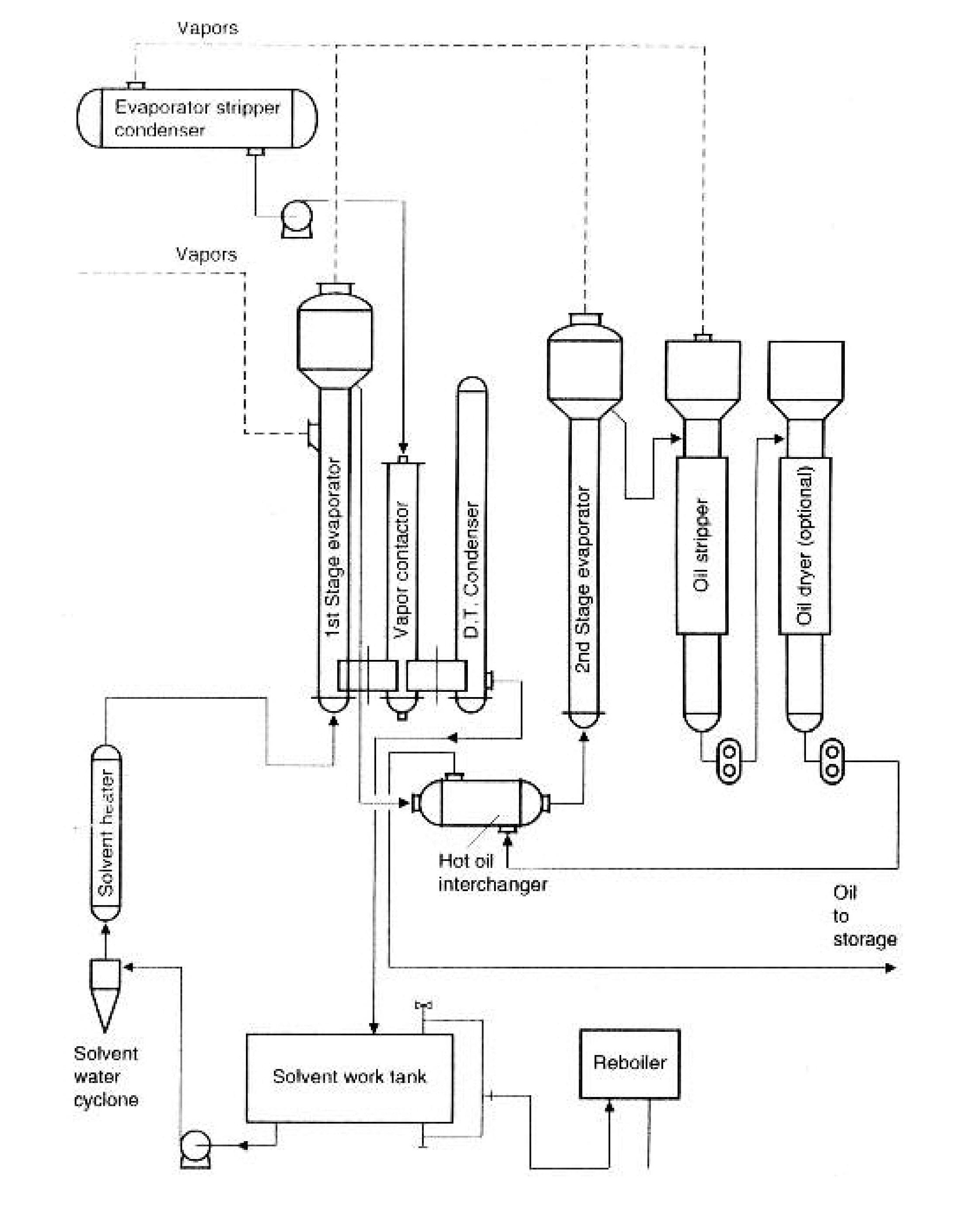
Solvent recovery flowchart. Source. Crown Model II.
Solvent Extractor. Crown Iron Works Co. Minneapolis, MN.



Hexane recovery is essential and mandated by the EPA. The remaining Hexane present in the non-condensable gases is removed via a mineral oil stripping process. Purchased mineral oil is mixed with the Hexane latent gases in the absorption column where the Hexane is absorbed by the cold mineral oil. The cold mineral oil latent with Hexane is then heated and pumped to the top of the stripping column. Steam from the stripper passes to a condenser for recovery of the solvent. Solvent free gases from the absorber are vented to the atmosphere through a steam ejector or fan. The recovered Hexane is recycled by the facility and mixed with fresh Hexane to be re-used in the extractor process.

Solvent Extraction and Solvent Recovery

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Extraction Condensate	Condensate	82ºC (180ºF)	CURC™	316L	CB/TC	Aflas®	11	
Water Stripper Feed	Water	Ambient	CURC™	316L	CB/TC	Aflas®	11	
Hexane	Hexane	Ambient	CURC™	316L	CB/TC	Viton®	11	
Skim Pit	Water	Ambient	CURC™	316L	CB/TC	Viton®	11	
Finished Oil	Raw Oil	Ambient	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Condensate Condenser	Glycol	Ambient	CURC™	316L	CB/TC	Viton®	11	
1st to 2nd Stage Pump	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
2nd Stage to Stripper	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
Stripper Condenser	Hexane Vapour	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
Vent Condenser	Hexane Vapour	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
Cold Mineral Oil	Mineral Oil	Ambient	CURC™	316L	CB/TC	Viton®	11	
Hot Mineral Oil	Mineral Oil/Hexane	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
A Stage	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
B Stage	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
C Stage	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
Slurry Pump	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	
Full Miscella	Miscella	115ºC (240ºF)	CURC™	316L	CB/TC	Viton®	11	

Degumming

Oils high in phosphorus, such as soybean, corn, and sunflower, may be degummed prior to refining. The degumming process is not a mandatory process due to the fact that the phosphatides (lecithin) can also be removed in the subsequent processes. The primary reason for degumming is to provide a crude-degummed oil suitable for storage or long transit or to produce lecithin to be sold as a by product for addition to livestock and poultry meal feed to increase the energy content.

Alkali-Refining

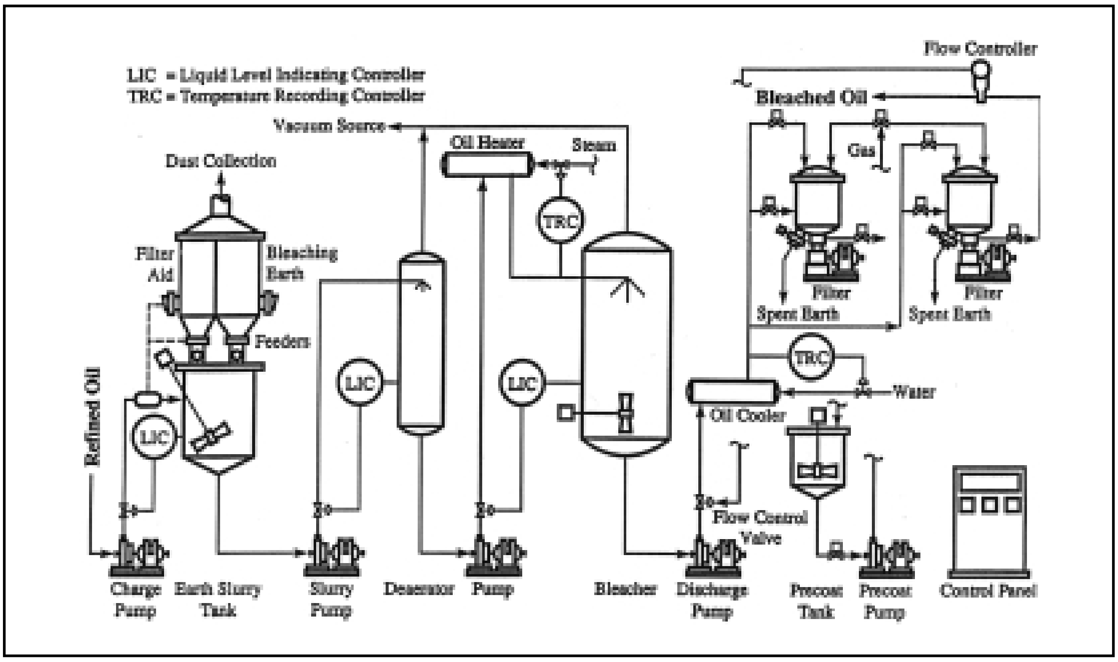
Alkali-Refining (also known as Caustic Refining) is the process designed to neutralize free fatty acids present in the oil. If degumming is not included in the facilities process, then caustic refining is the traditional first step for edible oil processing. This refining phase is important to remove the impurities in the oil, which have a tendency to turn dark when heated in the subsequent stages of the process. As the crude oil is delivered from the extraction plant, the oil is measured, cooled and injected with a measured amount of phosphoric or other acid. This acid has an affinity for the phosphatides (lecithin) and after bonding the acid and the phosphatides are removed from the process oil by a water wash. The oil and acid is brought in contact with the caustic wash in a high shear mixing application and passed through controlled heat exchangers and centrifuges where the Raw Oil and Soap Stock (Acid and Caustic) are separated. The Soap Stock is then sold as a by product or sent to waste water treatment. The oil is transferred to the next phase of the process.

Degumming and Alkali-Refining

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Phosphoric Acid	Phosphoric Acid	Ambient	CDSA™	316L	SiC/SiC//SiC/CB	Viton®	SW02	Water
Caustic Free Treat	Soduim Hydroxide (50% Caustic)	Ambient	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Refining Feed	Raw Soybean Oil	(160ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Dilute Caustic	Caustic+Water	Ambient	CURC™	316L	TC/TC	Aflas®		

Bleaching

Bleaching is the term given to describe the absorption cleansing process associated with edible oil refining. This process may include acid pretreatment, introduction of a retention aid and bleaching agent and the removal of the clay and absorbed materials. Other materials may also be introduced at this point, such as activated carbon for canola and other oils and filter-aids such as Diatomaceous earth, trisyl (small glass beads) and most recently rice hulls. The functions of the bleaching step is to remove or reduce the levels of pigments, oxidation products, phosphatides, soaps and trace metals in the oil. The bleaching process improves the color of the oil. These clays and bleaching agents may also be introduced via a slip stream line and inline style of mixer. Between the slurry tank and the bleaching vessel the oil is heated to prepare it for the bleaching process.



Typical continuous vacuum bleaching system.

The oil is then agitated in the bleaching vessel for several minutes and then passed through the bleaching filter to remove any solid materials. These bleaching filters may be either plate and frame or leaf filters. As these filters become blinded, they are taken off line and cleaned manually or by vibratory action. The cake is collected and mixed with the meal at the dry end of the process. The oil is then passed on to the hydrogenation and deodorizing processes.

Bleaching

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Trisyl Mixing (high shear)	Trisyl and Water	Ambient	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Oil Refinery Dryer Discharge	Trisyl and Oil	71ºC (160ºF)	CURC™	316L	TC/TC	Aflas®	11	
Trisyl Slurry Discharge	Trisyl and Oil	104ºC (220ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW03	Water
Clay Precoat	Diatomaceous Earth	Ambient	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Clay Slurry Feed	Diatomaceous Earth	Ambient	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW02	Water
Bleach Vessel Feed	Oil Slurry	79º (175ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW03	Water
Bleach Filter Feed	Oil Slurry	79º (175ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	SW03	Water

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Hydrogenation

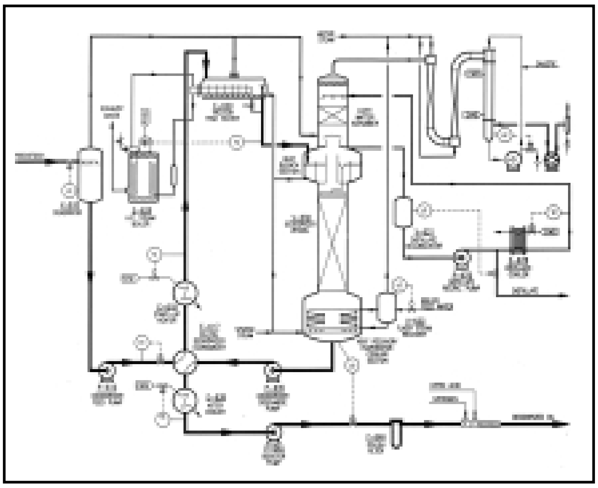
Hydrogenation is generally performed for one of two specific purposes. The first is to provide taste and smell stability and to enhance shelf life for unsaturated products. The second is to change the functional characteristics of the naturally occurring fats to those required for specific applications and functions. In the hydrogenation process the bleached oil is transferred to a reaction vessel where it is heated to 163ºC (325ºF) or higher to promote the reaction to commence. Water vapor is removed from the top of the vessel and catalyst (usually nickel) and hydrogen gas is added to the bleached oil and agitated per the individual processor recipe. When the processor has reached the desired results, the oil slurry is then passed through an oil-oil economizer to bring the hard oil to filtration temperature. Filter aids such as Diatomaceous earth are again added in this stage. The filter aid and hard oil slurry is then passed through the leaf press filter to remove the nickel catalyst and filter aid. The captured catalyst is recycled and the hard oil is sent through a finishing filter and on to storage or to the deodorization stage of the process.

Hydrogenation

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Heat Recovery Feed	Cotton Seed Oil	87ºC (190ºF)	DMSF™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Drop Tank Discharge	Seed Oil	177ºC (350ºF)	DMSF™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Catalyst Addition	Nickel Salts	121ºC (250ºF)	DMSF ™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Heat Recovery Feed	Seed Oil	87ºC (190ºF)	DMSF ™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Converter Discharge	Seed Oil	115ºC (240ºF)	DMSF™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Polish Filter Feed	Nickel Salts	121ºC (250ºF)	DMSF™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Catalyst Filter Feed	Nickel Salts	177ºC (350ºF)	DMSF™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil

Deodorization

Deodorization in the processing and refining of edible oil products is used to prepare the oil for use as an ingredient in margarine, shortening, salad oil, cooking oil, hard butters for the confectionery industry and many other products in the food industry. Deodorization is a steam stripping process wherein a good-quality steam, generated from deaerated and properly treated feedwater, is injected into the oil under low absolute pressure and sufficiently high temperature; 260ºC (500ºF), to vaporize the free fatty acid and odoriferous compounds and carry these volatiles away from the feed stock oil.



Continuous packed column deodorizer with heat recovery.

This process is carried out in either a Continuous Packed Column Deodorizer or a Votator Semi-Continuous Deodorizer and are the final phase of the process before the oil is transferred to either finished product holding tanks, packaging or the value added food stock area of some plants.

Deodorizing

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Citric Acid Addition	Citric Acid	Ambient	CURC™	316L	CB/TC	Aflas®		
Salad Oil Feed	Seed Oil	54ºC (130ºF)	CURC™	316L	TC/TC	Aflas®		
Stock Change	Seed Oil	79ºC (175ºF)	DMSF™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Discharge Stock Change	Seed Oil	79ºC (175ºF)	DMSF™	316L	TC/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Distillate Recycle	Seed Oil	79ºC (175ºF)	CURC™	316L	TC/TC	Aflas®	SP04	
Blend Feed	Seed Oil	79ºC (175ºF)	DMSF™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Deodorizer Discharge	Seed Oil	135ºC (275ºF)	DMSF™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil

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Raw Products, Blending and Storage

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Corn Oil Transfer	Corn Oil	49ºC (120ºF)	CURC™	316L	TC/TC	Aflas®	11	
Cotton Seed Transfer	Cotton Seed Oil	54ºC (130ºF)	CURC™	316L	TC/TC	Aflas®	11	
Base Stock to Blend Chest	Seed Oil	79ºC (175ºF)	CURC™	316L	TC/TC	Aflas®	11	
RB Unloading	Seed Oil	82ºC (180ºF)	CURC™	316L	TC/TC	Aflas®	11	
Hard Oil Discharge	Seed Oil	104ºC (220ºF)	DMSF™	316L	CB/TC//TC/CB	Aflas®	SP02/SP04	Mineral Oil
Tenox Conditioner	Vitamins & Water	Ambient	CURC™	316L	TC/TC	Aflas®	11	

Utilities

Application	Fluid	Temperature	AESSEAL®	Metallurgy	Faces	Elastomer	API Plan	Barrier
Boiler Feed Water	Water	177ºC (350ºF)	SMSS23™	316L	CB/SiC	Aflas®	23	
Deodorizer Distillant Recycle	Seed Oil	79ºC (175ºF)	CURC™	316L	TC/TC	Aflas®	11	
Spent Clay to Prep	Soap	82ºC (180ºF)	CDSA™	316L	TC/TC//TC/CB	Aflas®	53 / SW02	Water
Condensate Return	Condensate	77ºC (170ºF)	CURC™	316L	CB/TC	Aflas®	11	
Pit and Skim	Waste Water	Ambient	CURC™	316L	TC/TC	Aflas®	11	
Cooling Tower	Water	Ambient	CURC™	316L	TC/TC	Aflas®	11	
Hot Oil	Thermanol	260ºC (500FºF)	BQFD™	SAC	ANT.CB/TC	Graphite	Steam Quench	

Oilseed Processing Plant Equipment

Common Pumps:	Single Seal Selection	Double Seal Selection
Goulds 3196 ST	1.375" CURC™	1.375" CDSA™ / AZA4549
Goulds 3196 MT	1.750" CURC™	1.750" CDSA™ / AZA7130
Dean Brothers R434	1.750" CURC™	1.750" CDSA™ / AZA7479 / DMSF™
Dean Brothers R454	2.250" CURC™	2.250" DMSF™
Durco Mark III Gr II	1.875" CURC™	1.875" CDSA™
Viking LS4225	1.625" CON II™	
Viking QS4124	2.437" CON II™	
Viking M125	2.437" CON II™	
Viking Q124	2.437" CON II™	
Viking LL4125	1.437" CON II™	
Viking AK4195	1.437" CON II™	

Common Agitators:	
Chemineer 3HTNS-5, 2HTNS-3, 2HSNS-15	AZA7094 (for the 2HTNS-3)
Lightnin 108 RSES, NSES, VSES	AZA7665
Lightnin 208 VSES	AZA7682

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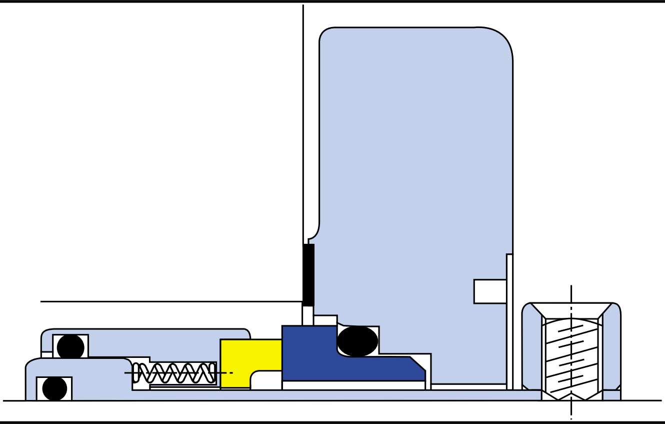
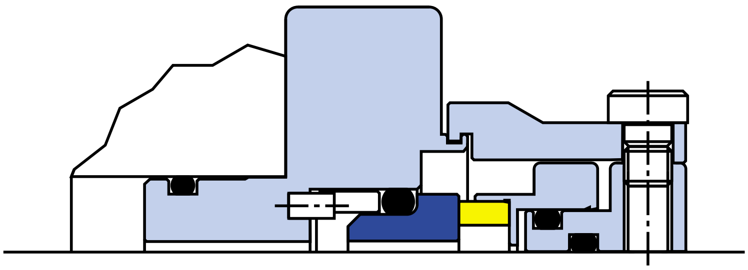
AESSEAL® Cartridge Mechanical Seals Used in Oil Seed Plants

Convertor II™



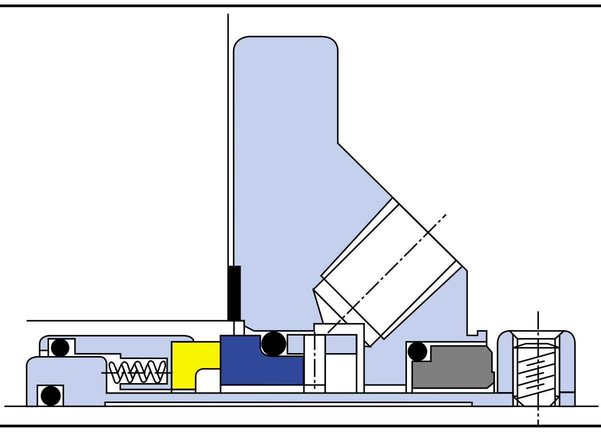
Special NCM™



Stuffing Box Pressure Not to Exceed 15psi (1 bar)

Z Number	Equipment
AZA7665	108 Lightnin Agitator
AZA7682	208 Lightnin Agitator

CURC™



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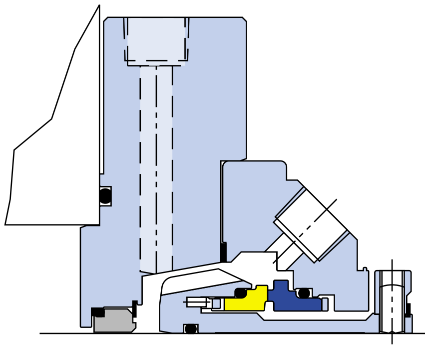
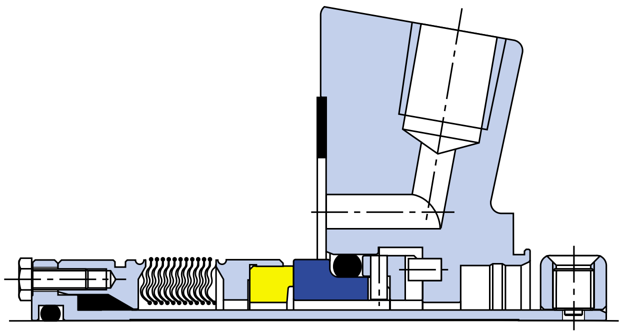
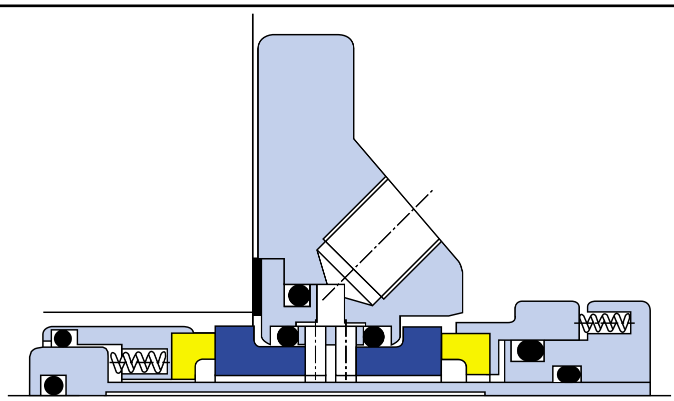


BQFD™

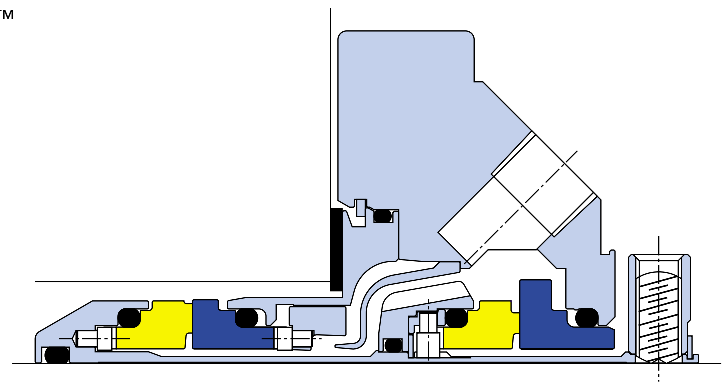


CDSA™



Z Number	**Equipment**
AZA4549	3196ST Standard Box Goulds Pump
AZA7130	3196MT Standard Box Goulds Pump
AZA7479	R434 Standard Box Dean Brothers Pump
AZA5419	R454 Standard Box Dean Brothers Pump

DMSF™



Z Number	**Equipment**
AZA7234	Goulds 3196ST (Pump stuffing box bore will need modifying to 2.125" / 54mm).

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AESSEAL®

OIL SEED

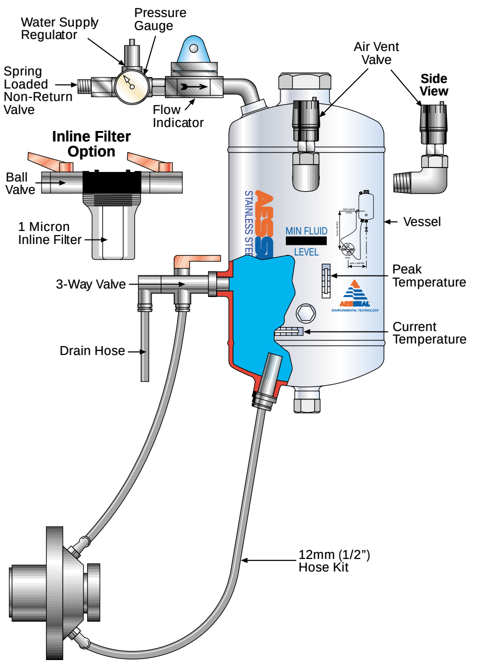
PROCESSING PLANTS

L-UK/US-OILSEED-01

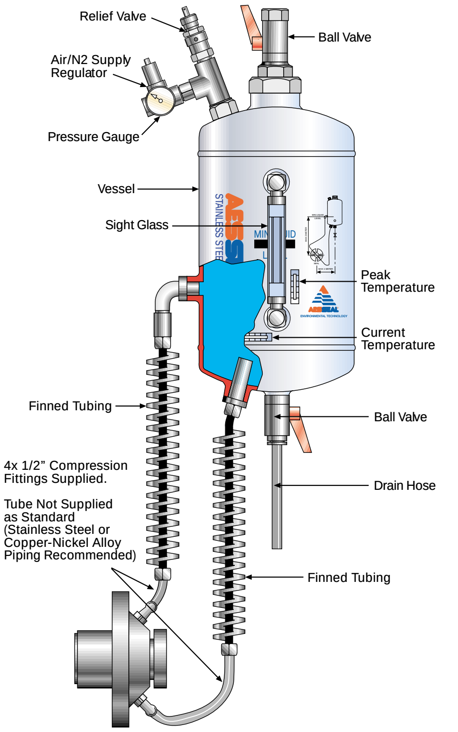
IN 4564 - 01/2002

Barrier Systems for Double Seals

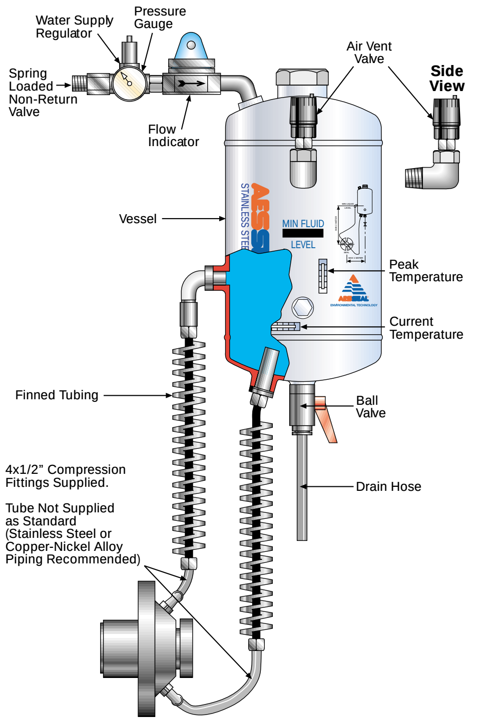
SSE10™ SYSTEM W2
STANDARD WATER MANAGEMENT VESSEL CODE VSE/SW02



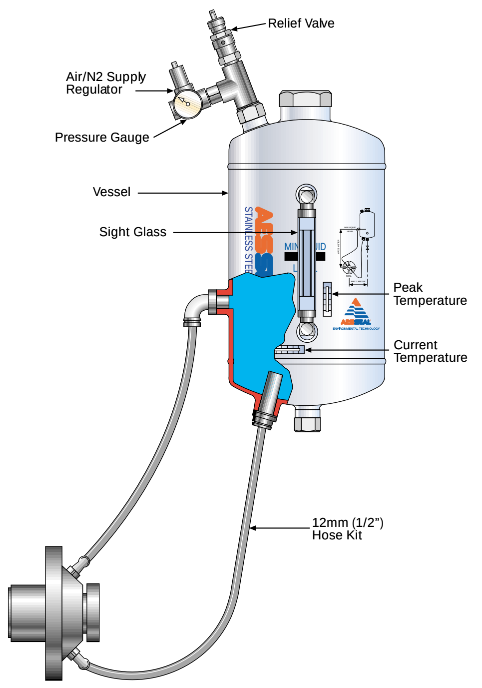
SSE10™ SYSTEM P4
HOT PRESSURE SYSTEM CODE VSE/SP04



SSE10™ SYSTEM W3
HOT WATER MANAGEMENT VESSEL CODE VSE/SW03

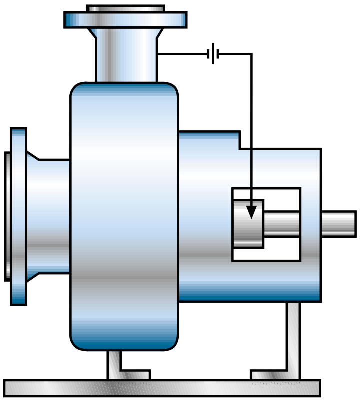


SSE10™ SYSTEM P2
BASIC PRESSURE SYSTEM CODE VSE/SP02

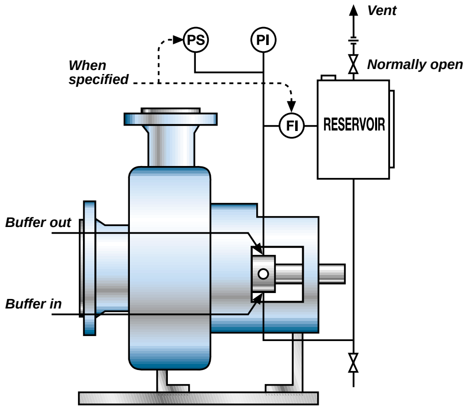


AESSEAL® ENVIRONMENTAL TECHNOLOGY

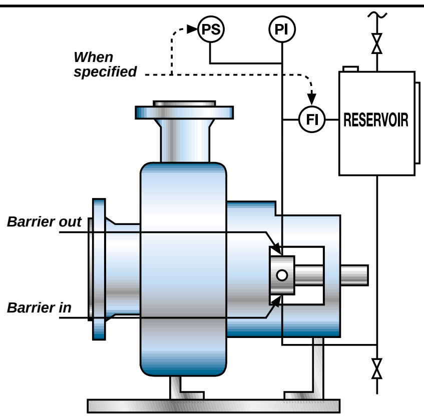
API Plans Schematic Details



API PLAN NO.11
Product Recirculation from Pump Discharge to Seal through a Flow Control Orifice.



API PLAN NO.52
Unpressurized Buffer Reservoir, Circulation normally maintained by Pumping Ring. Also system normally continuously vented.



API PLAN NO.53
Pressurized Barrier Fluid Reservoir. Barrier pressure is greater than Product pressure. Circulation is maintained by a Pumping Ring.

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Case Histories

CASE No. 742H

In an edible oil extraction plant a Durco GRP MKII pump was fitted with a CDSA™ C/TC/V/TC/C/V which was supported by a Pumppac MKII using Rapeseed oil at 60 psi (870 barg). Plant water was fed through the cooling coil. Commissioned March 1996.

CASE No. 1308J

In a soybean oil plant a Lightnin AGITATOR was fitted with an NCM™ (Mixer seal) TC vs. TC. Shaft speed 200 RPM. Product temperature running at 350°F . Aflas® was used as the Inboard Seal Elastomer. Commissioned September 2001. The seal replaced a competitors Canister seal which had failed within 6 months of being fitted.

CASE No. 1309J

In a Soybean Oil Refining Plant a CDSA™ TC/TC/A/TC/CB/V was used on a Horizontal Cent. Bleach filter pump API Plan No:53 AESSEAL® system used: SW03 with 3 Way Valve. Commissioned October 2000. The seal replaced a competitors seal which had failed within 3-4 weeks of being fitted.

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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 'A' on a case history refers to information which was current on the 31st. January, 1989.

Issue 'B' refers to information which was current on 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.

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 'A', Issue 'B', Issue 'C', Issue 'D', Issue 'E', Issue 'F', Issue 'G', Issue 'H', Issue 'I' or Issue 'J'.

For more detailed information, please contact our Applications Department.

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FOR FURTHER INFORMATION AND SAFE OPERATING LIMITS CONTACT OUR TECHNICAL SPECIALISTS AT THE LOCATIONS BELOW.

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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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AES / DOC / IN 4564 01/2002

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