BUBB-LESS ELIMINATOR®

BUBBLE REMOVAL DEVICE

What is a “Bubb-less Eliminator”?

Answer: Bubbles cause various problems. “**BUBB-less Eliminator”*** can solve these problems.

Applications

The Bubb-less Eliminator will work effectively to remove bubbles from fluids in the following fluid samples:

1.Chemical Fluids

- Coating materials
- Paint and ink
- Chemical fluids
- Polyethers, Polyvinyl alcohol, Ethylene glycol

2.Liquid foods

3.Industrial oils

- Engine oil
- Gear oil
- Turbine oil
- Hydraulic oil

4.Biodegradable oil

5.Fire resistant oil

**The Bubb-less Eliminator is manufactured by Opus Systems Inc., 3-25-20 Okusawa Seetagaya-ku, Tokyo 158-0083, Tokyo Japan.*

The *Bubb-less Eliminator** is manufactured in four different configurations: standard type, in-line type, coater-type and the sanitary type designs to facilitate their installation and use in a wide variety of hydraulic circuits. These are illustrated in Figure 2 along with a schematic drawing of the inside geometry of each device.

A **B** **C** **D**

Figure 1 – The Four Configurations of the "Bubble Eliminator" are A) standard, B) in-line, C) coater, and D) sanitary.

Features

(A) Installation of an Eliminator in the return line or processing line

1.Bubbles are removed from flowing fluids.
2.Various components, such as heaters, coolers, and filters can be incorporated in series.
3.The Eliminator can also be installed inside the reservoir to save space.

(B) Installation in combination with a feed pump

1. If the flow system on the suction side of the pump is downstream of the Eliminator, then theoretically bubbles can be completely eliminated.
By means of adjusting the rate of flow, the flow for the next processing flow for the next processing flow can be controlled.
2. If a throttle valve located on the pump suction side decreases the pressure between the throttle valve and pump, the capacity for the fluid may become over-saturated with dissolved gas. This will cause bubbles come out of the fluid on the pump suction side and flow into Eliminator where they can then be removed from the system. When the amount of dissolved gas is decreased, the rate of absorption of gas into the fluid will increase so that the fluid will adsorb more bubbles that dissolve into oil.
(In some cases where chemical fluids are involved, this method may not suitable)

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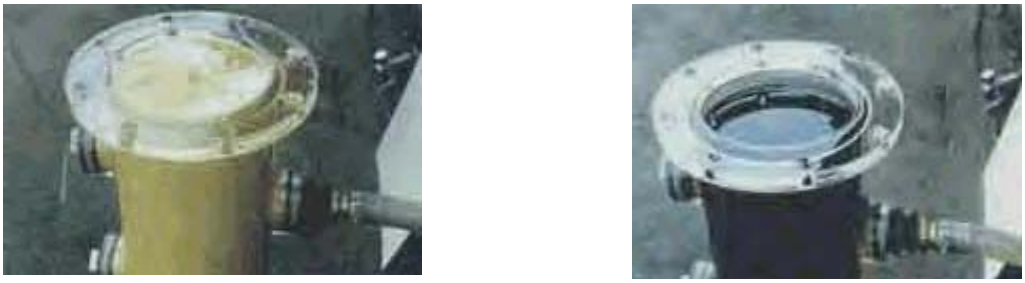
Principles of Removing Bubbles

There are certain position-dependent centrifugal forces created in all parts of the swirl flow, and the bubbles tend to move toward the central axis of the *Bubble Eliminator* due to the difference in centrifugal force. Small bubbles are trapped creating an air column in the vicinity of central axis of the swirling flow near the area where the pressure is the lowest. When backpressure is applied at the downstream side of the *Bubble Eliminator*, the collected bubbles will be ejected through the vent port. Figure 1 illustrates the air bubble removal ability of the *Bubble Eliminator* when used with a severely aerated hydraulic fluid.



A **B**

Figure 2 – Example of air bubble removal, A) aerated fluid, B) de-aerated fluid.

A schematic illustration of the operation of a Bubb-less Eliminator is produced in Figure 3.

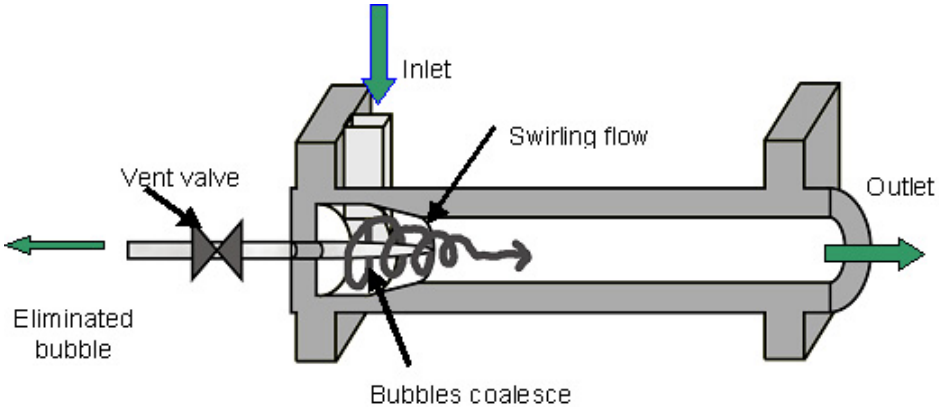


Figure 3: Schematic illustration of the operation of a Bubb-less Eliminator

1) For given parameter for creating swirl, the Bubb-less Eliminator is consists of a tapered-tube that is designed such that a chamber of circular cross-section becomes smaller, then connected with a cylindrical straight tube chamber. Fluid containing bubbles flows tangentially into the tapered tube from an inlet port and generates a swirling flow that circulates the fluid through the flow passage.?

2) The swirling flow accelerates downstream, and the fluid pressure along the central axis decreases downstream. From the end of the tapered-tube, the swirl flow decelerates downstream and the pressure recovers toward the outlet.

3) There are certain position-dependent centrifugal forces created in all parts of the swirl flow, and the bubbles tend to move toward the central axis of the Eliminator due to the difference in centrifugal force. Small bubbles are trapped which makes an air column in the vicinity of central axis of the swirling flow near the area where the pressure is the lowest.

4) When back pressure is applied at the downstream side of the Bubb-less Eliminator, the collected bubbles will be ejected through the vent port.

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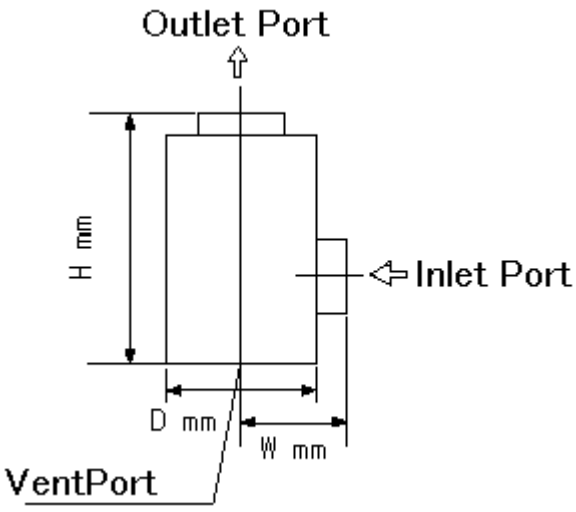
Standard Type

Please note that these dimensions will be changed, in some cases, without previous notice.
Dimensions will be confirmed before manufacturing by means of drawing for approval.



Type	Flow Rate l/min	D	H	W	Port (Nominal mm)		
					Inlet	Outlet	Vent
BM- 10	10	49	135	35	15	15	6
BM- 30	30	76	200	52	25	20	8
BM- 60	60	76	220	58	32	25	8
BM-120	120	115	280	90	40	40	15
BM-180	180	140	300	100	50	50	15
BM-240	240	165	315	155	65	65	20
BM-330	330	165	315	155	65	65	20

There is no upper limit for the flow rate.

BM-330 (Flow rate F330 l/min)

BC-16(left)
(Material:Stainless Steel)
(Flow rate F16 l/min)
BC-60(right)
(Material:Stainless Steel)
(Flow rate F60 l/min)

In-Line Type

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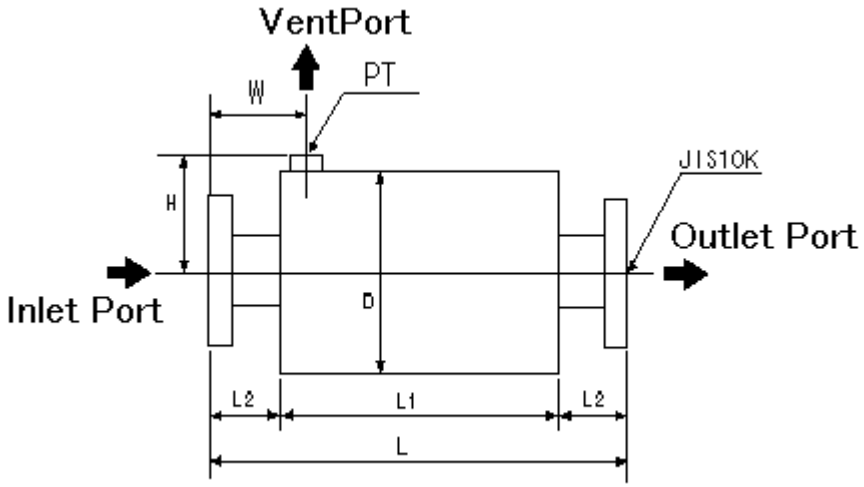

Type	Flow Rate (l/min)	D	L	L 1	L 2	H	W	Port (Nominal mm)		
								Inlet	Outlet	Vent
BM- 500	500	216	470	390	40	125	67	80	80	20
BM- 600	600	216	470	390	40	130	73	80	80	25
BM- 700	700	267	500	410	45	155	78	80	80	25
BM- 800	800	267	500	410	45	155	78	100	100	25
BM-1000	1000	267	500	410	45	155	78	100	100	25
BM-1200	1200	318	590	430	80	180	120	125	125	32
BM-1500	1500	318	590	430	80	180	120	150	150	32

There is no upper limit for the flow rate.

BC-1500
(Material:Stainless Steel)
(Flow rate F1500 l/min)

Coater Type

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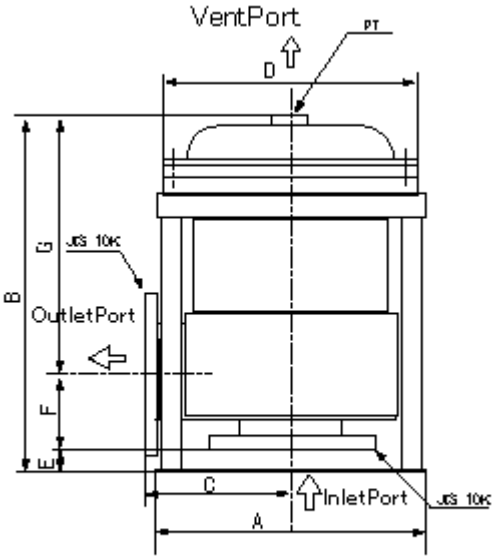

BC-600
(Flow rate F600 l/min)

Type	Flow Rate (l/min)	A	B	C	D	E	F	G	Port (Nominal mm)		
									Inlet	Outlet	Vent
BC- 400	400	325	515	180	300	40	90	385	80	80	20
BC- 600	600	365	534	200	340	40	107	387	100	100	20
BC- 800	800	395	564	220	370	40	120	404	125	125	20
BC-1000	1000	395	566	220	370	40	120	406	125	125	25
BC-1200	1200	415	613	240	390	40	133	440	150	150	32
BC-1500	1500	455	625	250	430	40	133	452	150	150	40

There is no upper limit for the flow rate.

BC-800
(Flow rate F800 l/min)

BC-1250
(Flow rate F1250 l/min)

Sanitary Type

Please note that these dimensions will be changed, in some cases, without previous notice.
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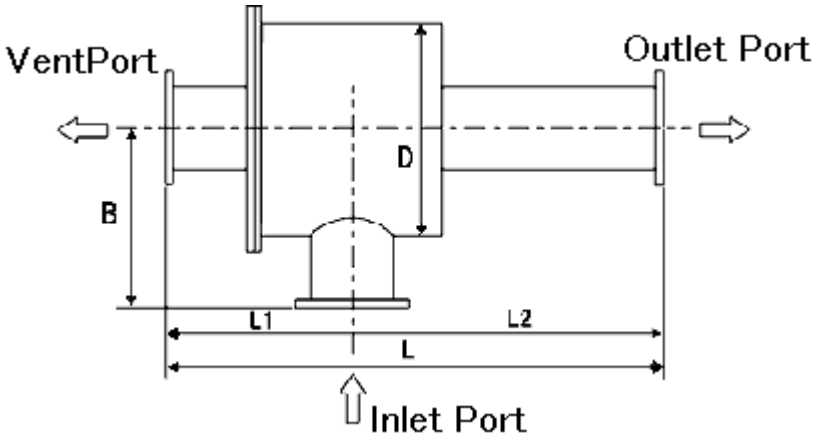

Type	Flow Rate (l/min)	D	L	L 1	L 2	W	Port (Nominal mm)		
							Inlet	Outlet	Vent
BS- 20	20	65	200	80	120	60	25	25	12
BS- 50	50	80	200	80	120	60	32	32	12
BS-100	100	90	250	100	150	75	40	40	12
BS-150	150	100	300	100	200	75	50	50	25
BS-200	200	125	350	120	230	100	65	65	25
BS-300	300	150	400	150	250	100	80	80	25

There is no upper limit for the flow rate.

BC-150
(Flow rate F150 l/min)

Case Histories

5 years ago, there was an air emulsion problem in the lubrication oil for turbo chargers of container carriers (tonnage 66,000 ton), newly designed and built by Mitsubishi Heavy industries. The lubrication oil became an air emulsion which was caused by the churning effect of bearing rotation. Bubbles in oil greatly influence the performance of lubrication system and may cause major problem such as degradation of lubrication, oil temperature rise, loss of oil and creation of sludge.

Since then 25 Bubb-less Eliminators* (flow rate 660 L/min) have been used for the container carriers. The Bubb-less Eliminator* was installed in these circuits and the problem was solved by effectively removing the small bubbles from the fluid. (cf. Figure 4)

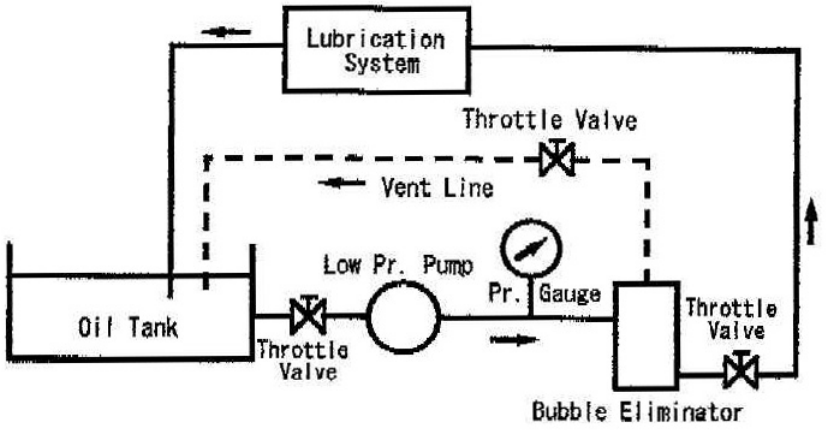

Figure 4 Turbo-charger Lubrication System

Due to the change of regulations in Japan, a manufacturer was requested to install various first-aid items to their fire engines with ladder. To create space in the fire engines for these items, they tried to use a smaller oil tank. If the oil does not reside in the tank long enough for the bubbles to reach the surface, the bubbles are drawn into the suction line and many problems occur. Then the Bubb-less Eliminator* was introduced to prevent air bubbles entrainment problem in the hydraulic oil systems. As a result bubble removed concrete benefits were obtained including, reduce oil temperature rise and noise reduction of the hydraulic pump. Seventeen Eliminators (flow rate 40-220 L/min) have been installed this for. The devices have been installed on the cover plate of oil tank to save space. (cf. Figure 5)

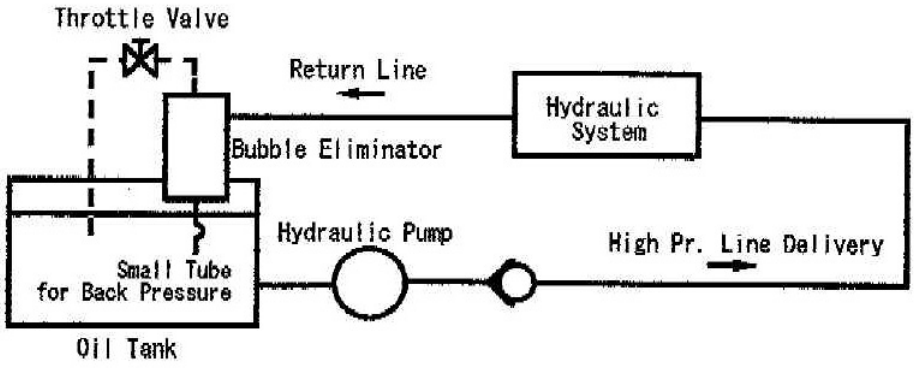

Figure 5 Fire Engine Hydraulic System

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A manufacturer of high precision hydraulic servo pressed for metal powder molding has used the Bubb-lesss Eliminators* (flow rate 40-440 L/min) to prevent temperature rise of oil. Without the device, oil temperature becomes excessively high and elongation of press frame results causing reduced causes low accuracy of the molded product. (cf. Figure 6)

Toshiba Machinery Co. has adopted a similar circuit for hydrostatic bearings of roll grinding machines. The oil temperature of the hydraulic system must be strictly maintained within 20±1℃ to maintain keep accuracy of all grinding roll. Eighteen Bubb-less Eliminators* (flow rate 40 L/min) had been installed.

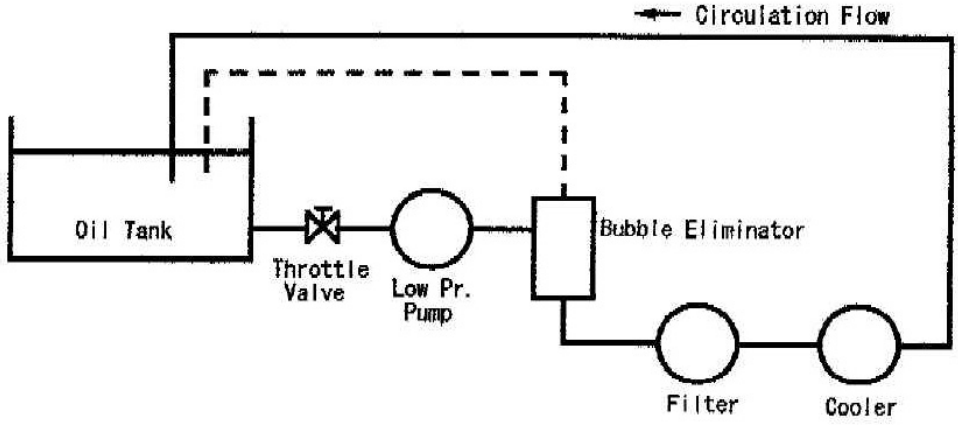

Figure 6 Servo Press Off-line System

Two hydro-electric power stations (0.3 megawatt and 0.26 megawatt) are using Bubb-less Eliminators* (flow rate 140 L/min) for thrust bearing lubrication systems to prevent damage of the thrust bearings and high-pressure pumps. (cf. Figure 7)

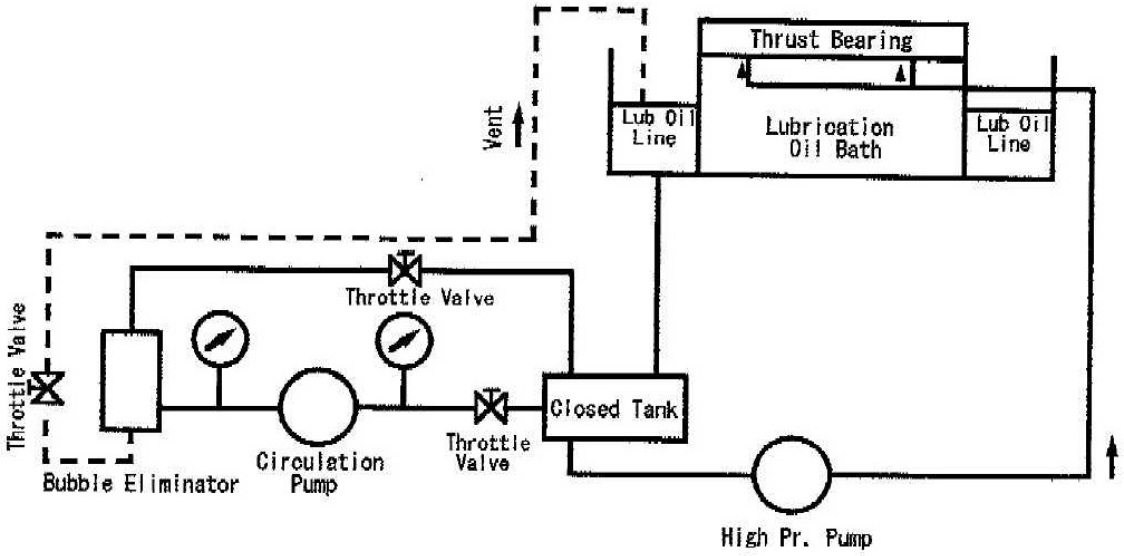

Figure 4 Hydro-electric Power Station / Thrust Bearing
7 Lublication System

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John Deere Product Engineering Center / Agricultural Engineering Hydraulic Core Technology evaluated the Bubb-less Eliminators*, and successful result was obtained. (cf. Figure 8)

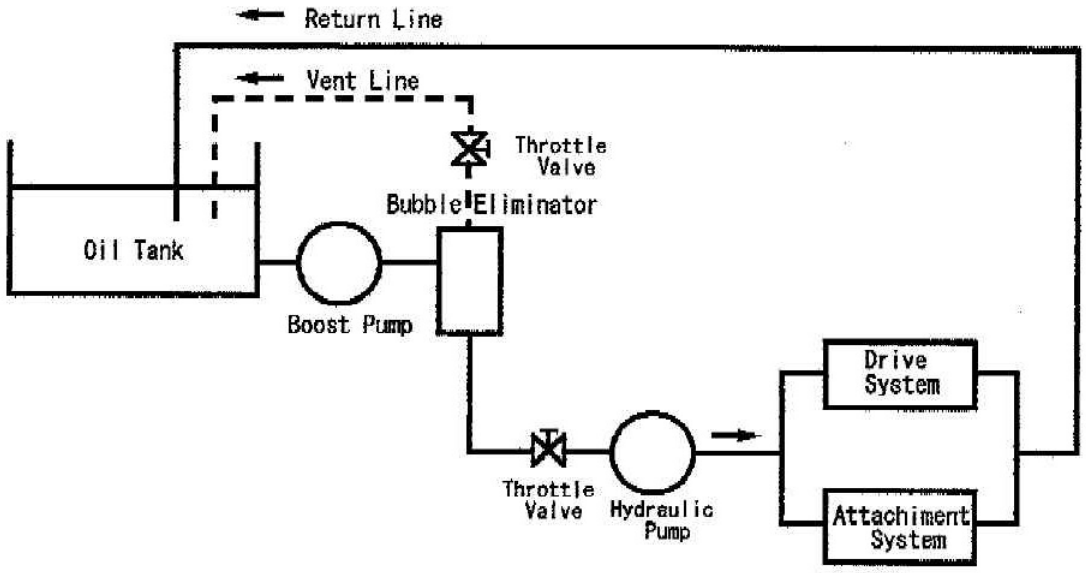

Figure 8 Tractor Hydraulic System

Vickers Tedeco Division successfully evaluated the Bubb-less Eliminator (30 L/min) to the circuits shown in the Figure 9. Their deaeration performance data shows that the device is effective in removing entrained air from combined oil and air flows.

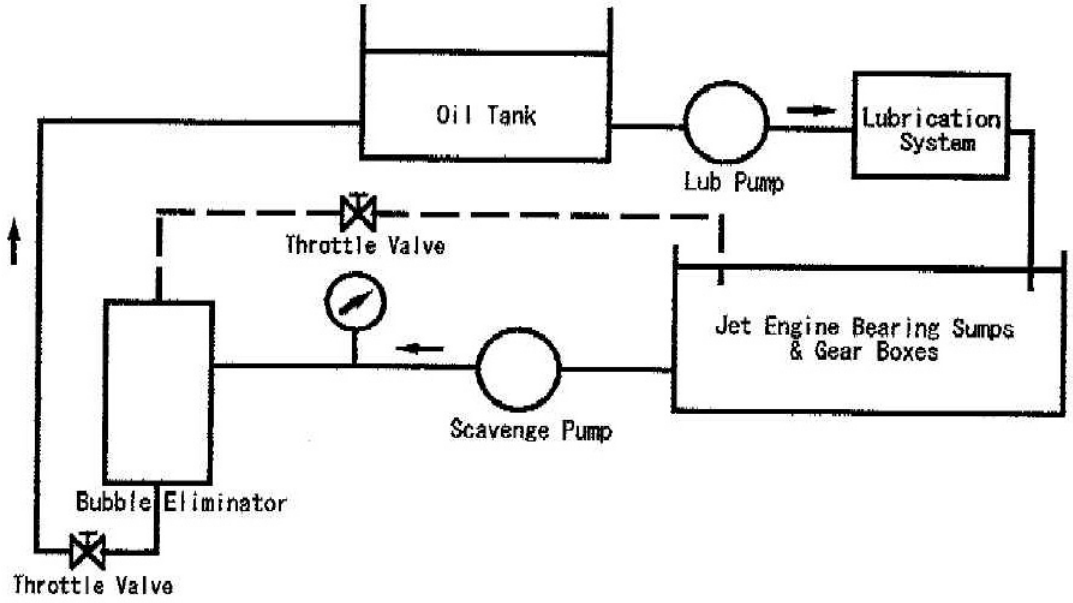

Figure 9 Jet Engine / Lubrication System

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Figure 10 provides a basic circuit used by an oil hydraulic company in Japan for successfully evaluation of the Bubb-less Eliminators* for hydrostatic transmissions. (cf. Figure 10)

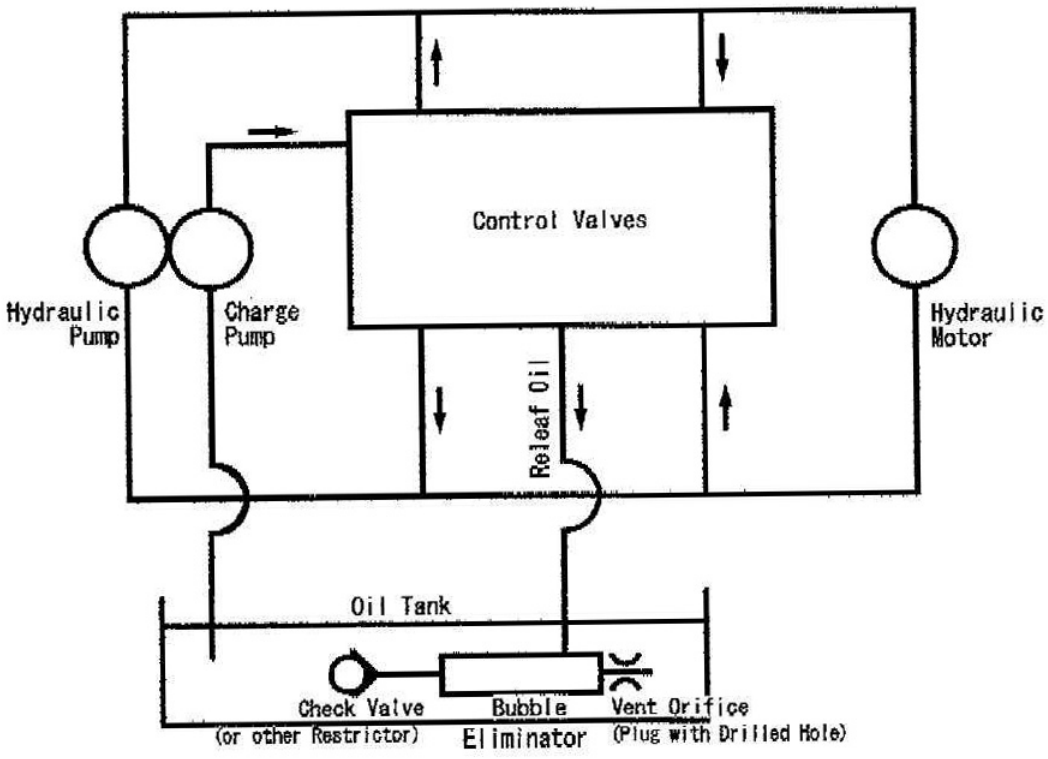

Figure 10 Hydrostatic Transmission

Please Contact G.E. Totten & Associates, LLC for more information on the Bubb-less Eliminator* Opus System's at:

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