Upscaling Report oil separators

REPORT NO:
150442-4

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Appendices: 2

Customer:

Contact:	Jonas Groth
Company:	Watercare
Address:	Stejlebjergvej 14
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Material: The oil separators from Watercare with nominal sizes NS30-NS80, class 1. There are integrated sludge traps in a separate chamber in all oil separators.

All materials are PE except the inlet and outlet.

Purpose and scope of the test: The Pipe Centre at Danish Technological Institute is a Certified Body and can conduct tests of oil separators according to the European Standard EN 858-1:2002+A1:2005. The purpose of this report is too upscale the design and effectiveness of the oil separators NS30-NS80 from Watercare based on test for the NS6-NS20 oil separators.

Sampling: The drawings and calculations were sent to the Danish Technological Institute in Taastrup by Watercare and received in February 2023.

Method: The verification was carried out according to:

1. EN 858 – 1, 2002+A1:2005, clause 6.2.4, 6.3 and 6.5.6
2. AFNOR – document from 2005 concerning the hydraulic performance of separator larger than NS30.

Period: The verification was carried out in February 2023.

Result: Based on test for the NS6-NS20 oil separators, the verification shows that the NS30-NS80 oil coalescers separators, meet all relevant requirements in EN 858-1, clause 6.2.4, 6.3 and 6.5.6, see results in appendix 1. The upscaling has been based on the residence time, total volume and filter contact time.

Similar principles can be used for scaling up oil separators larger than NS80.

Terms: The verification has been performed according to EN 858-1:2002+A1:2005. The verification is only valid for the verified specimen. The test report may only be extracted if the laboratory has approved the extract.

Place: Date: 28.02.2023, Danish Technological Institute, Taastrup, Pipe Centre

Ulrik Hindsberger

Signatur: Ulrik Hindsberger
Center Manager

Appendix 1

6.2.4 **Materials**

All materials are PE except the inlet and outlet. All materials in pe must be resistant to the influences on which they are exposed to according to EN 858-1, section 6.2.4. All metal parts must be made of stainless steel AISI 304 or 316. In some countries the legal authorities recommend that manufacturers use stainless steel AISI 316L instead of AISI 304 for oil separators.

6.3.2 **Watertightness according to 8.4.1**

All oil separators are tested for water tightness before the leave the factory. Danish Technological has made watertightness test for different oil separators by filling up water to 100 mm above the maximum operational liquid level. There were no leaks after 20 min of testing. The tightness of the extension shaft has not been tested. If extension shafts are used, the tightness of the connections must be tested after installation.

6.3.5 **Inlets and outlets**

Minimum nominal diameters for inlets and outlets are OK according to table 1 in EN 858-1.

Size	Inlet	Outlet
NS30	315 mm (OK)	315 mm (OK)
NS40	315 mm (OK)	315 mm (OK)
NS50	315 mm (OK)	315 mm (OK)
NS60	315 mm (OK)	315 mm (OK)
NS70	315 mm (OK)	315 mm (OK)
NS80	315 mm (OK)	315 mm (OK)

6.3.6 **Internal component**

All internal components are accessible for maintenance and inspection via 3-5 accesses/access pipes.

6.3.7 **Sludge traps**

There are integrated sludge traps in all oil separators in the bottom of the separators in the bottom of the separators up to NS25. Above NS25 the sludge trap is in a separate chamber, see also the volumes at the drawings in appendix 2. All the volumes are larger than 100 x NS.

Size	**Sludge trap volume, see drawings**
NS30	4.0 m^3
NS40	5.35 m^3
NS50	6.7 m^3
NS60	8.0 m^3
NS70	9.4 m^3
NS80	10.7 m^3

6.5.6 **Upscaling based on determination of the nominal size**

The oil separators NS 6, NS 10 and NS20 has been tested according to clause 6.5.6.

The oil separators NS30-NS80 have been scaled up based on 3 parameters:

- Ct: Contact time in the coalescers unit
- R_t: Residence time in the separating zone
- V_T: Total volume

Upscaling is based on the tests carried out on the three oil separators NS6, NS10 and NS20.

C_t: Contact time in the coalescers unit

Size	Contact time in the coalescers unit
NS6	1 filter, 1 layer
NS10	1 filter, 1 layer
NS20	1 filter, 2 layers
NS30	2 filters, 2 layers
NS40	2 filters, 2 layers
NS50	3 filters, 2 layers
NS60	3 filters, 2 layers
NS70	4 filters, 2 layers
NS80	4 filters, 2 layers

R_t: Residence time in the separating zone

Average residence time for NS6, NS10 and NS20 is ≈ 149,22 sec.

Size	Residence time in the separating zone (sec)
NS6	≈ 122 s (calculated)
NS10	≈ 170 s (calculated)
NS20	≈ 156 s (calculated)
NS30	>149.5 s
NS40	>149.5 s
NS50	>149.5 s
NS60	>149.5 s
NS70	>149.5 s
NS80	>149.5 s

V_T: Total volume

Size	Volume based on the residence time	Total volume: separation zone + oil capacity volume
NS30	>4485 l	1895 + 2957 = 4852 l (OK)
NS40	>5980 l	2406 + 3579 = 5985 l (OK)
NS50	>7475 l	3220 + 4404 = 7524 l (OK)
NS60	>8970 l	3785 + 5186 = 8971 l (OK)
NS70	>10465 l	4595 + 5911 = 10506 l (OK)
NS80	>11960 l	5352 + 6808 = 12160 l (OK)

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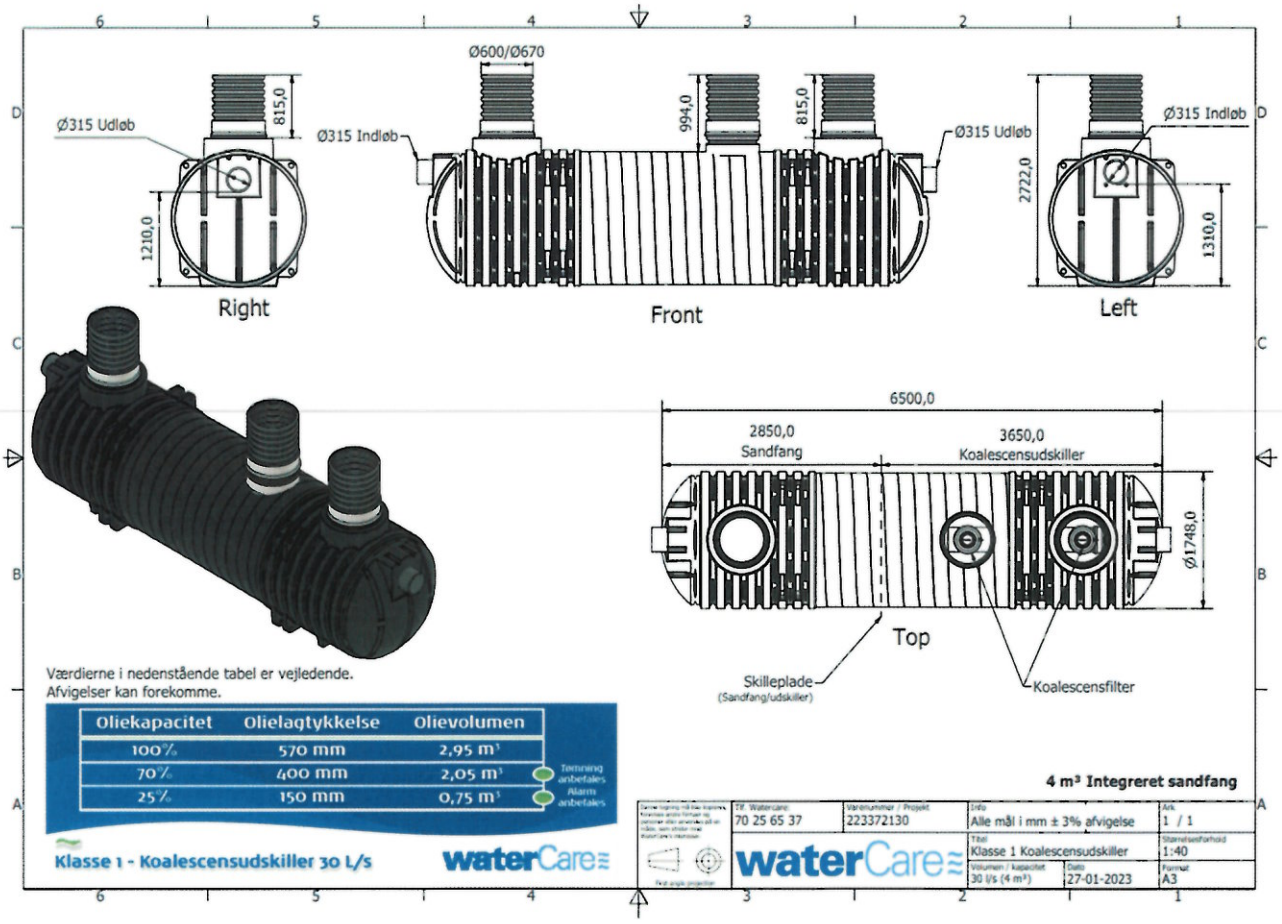
Appendix 2: Drawing of the NS30 oil coalescers separator



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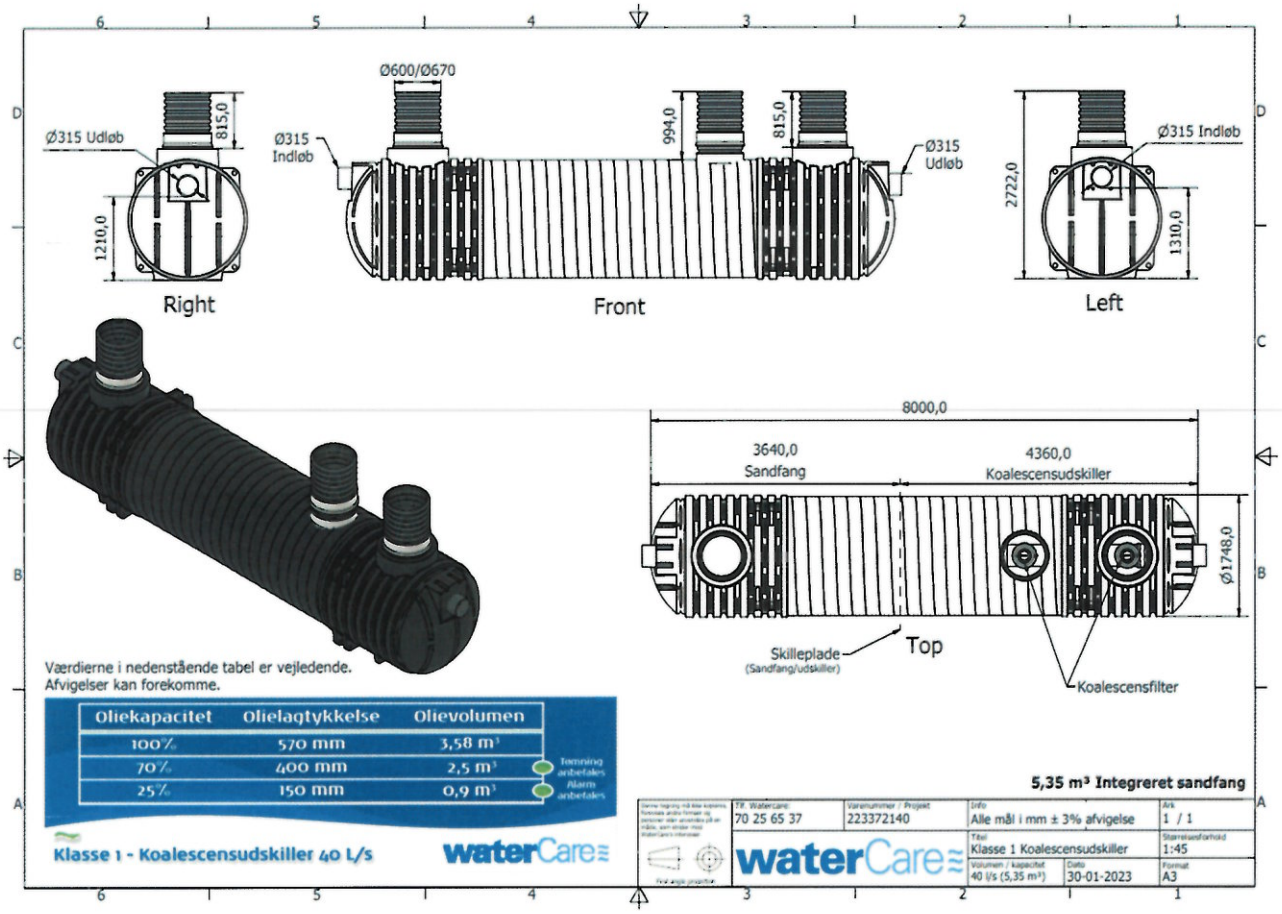
Appendix 2: Drawing of the NS40 oil coalescers separator



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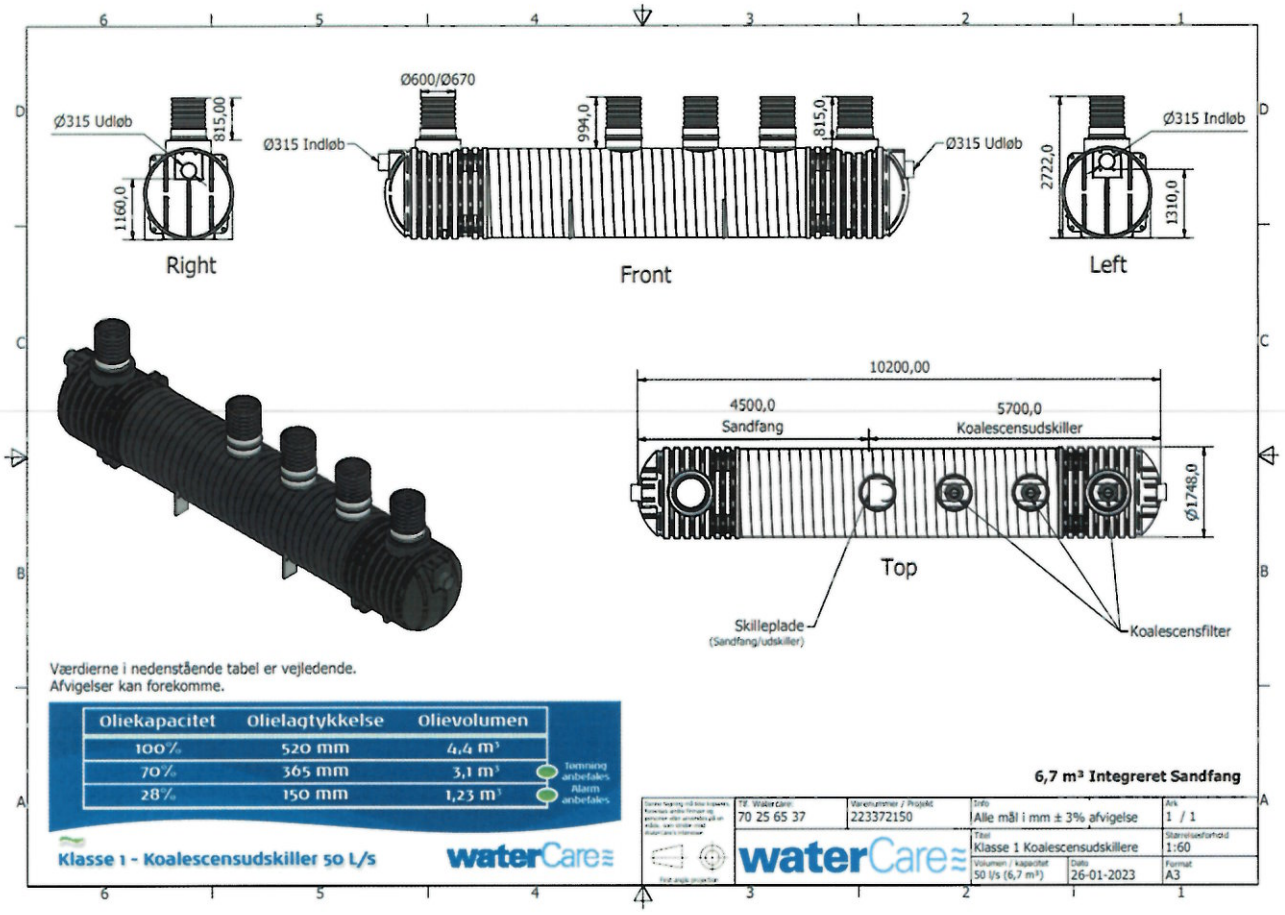
Appendix 2: Drawing of the NS50 oil coalescers separator



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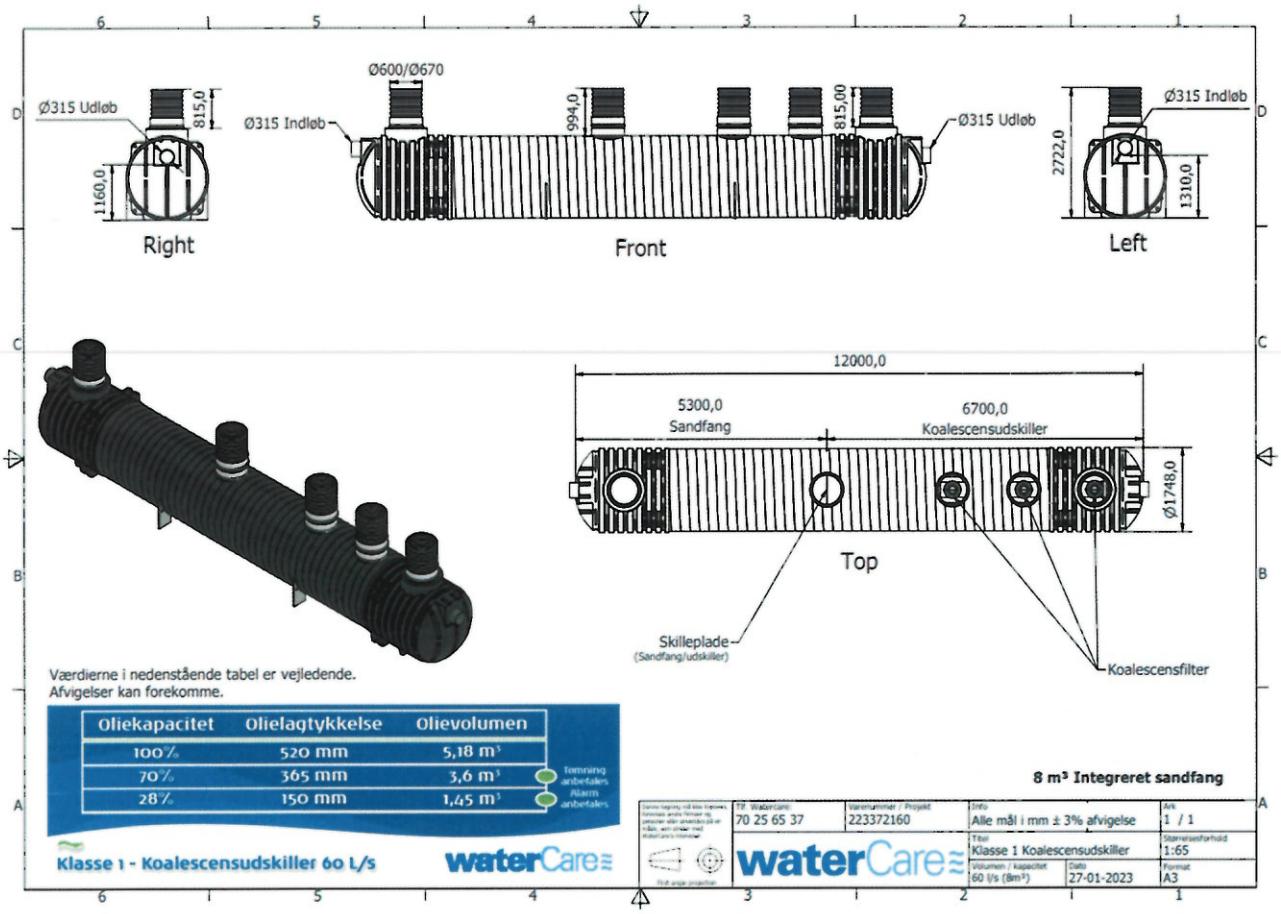
Appendix 2: Drawing of the NS60 oil coalescers separator



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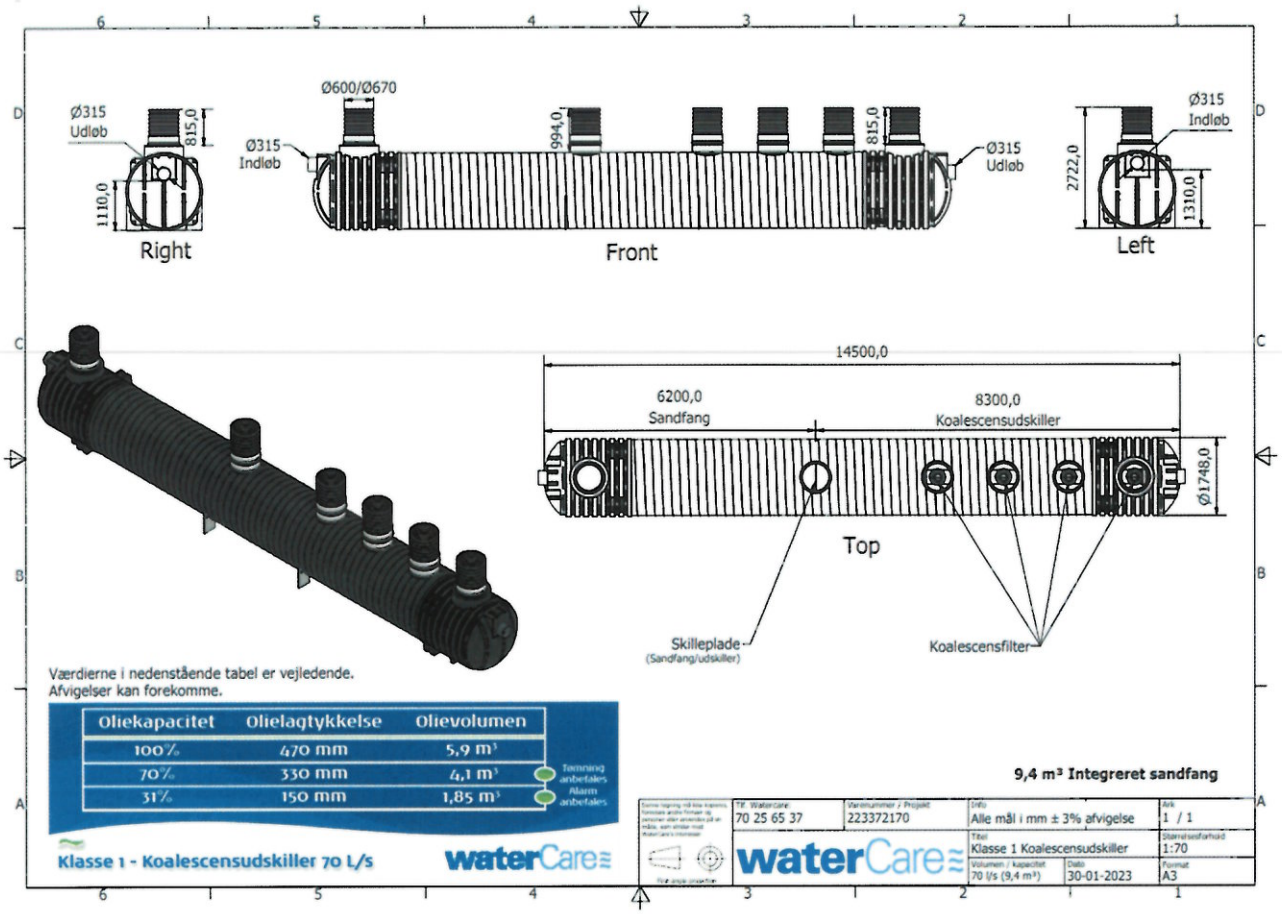
Appendix 2: Drawing of the NS70 oil coalesces separator



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Appendix 2: Drawing of the NS80 oil coalesces separator