



# PELAGIC V18 HYDRAULIC CONTROL FLUID

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## TECHNICAL MANUAL



THE QUEEN'S AWARDS  
FOR ENTERPRISE:  
INNOVATION  
2012

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## DOCUMENT BACKGROUND

This manual outlines technical data gathered to date, both within Niche Product laboratories, and using independent third parties, on Pelagic V18 Water Based Hydraulic Control Fluid.

At Niche Products our aim is to develop innovative new products, which will answer the need of the Industries we serve in terms of Technical Performance and Environmental Acceptability, both today and in the future.

Our product development process involves talking to potential customers, and to technical departments within major Equipment Manufacturers, along with environmental bodies and governments, to help identify exactly what the industry requires.

This report will provide a broad technical overview on the Technical Performance of Pelagic V18 and will also demonstrate our commitment to producing superior products that offer a real technical advance for this market sector.

Test methods used in the acquisition of the test data have been summarised as appropriate, with full test methods available on request.

## DOCUMENT REVISION HISTORY

Issue No.	Revision	Issue Date	Authorised by	Position
2	0	02/01/12	David Gleeson	R&D Manager
3	0	25/06/13	David Gleeson	R&D Manager
4	0	17/07/13	David Gleeson	R&D Manager

Please note that this document is subject to revision on a regular basis. Please ensure you have the latest revision before using this data in applications of a critical nature.



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*Information given in this publication is based on Technical Data gained in our own and other laboratories and is believed to be true. However, if the material is used in conditions beyond our control, we can assume no liability for results obtained or damaged incurred through the application of the data present herein.*

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## 1.0 TYPICAL PHYSICAL PROPERTIES

Property	Pelagic V18
Appearance	Clear Mobile Liquid
Colour	Colourless
Viscosity (cS) @ 0°C	125
Viscosity (cS) @ 20°C	35
Viscosity (cS) @ 40°C	18
Pour Point (°C)	-30
Flash Point	N/A
pH @ 20°C	9.5
Total Acid Number (mgKOH/g)	1.65
Total Base Number (mgKOH/g)	26.2
Density @ 20°C	1.05
Bulk Modulus (Nm <sup>-2</sup> X 10 <sup>9</sup> )	2.60
Specific Heat Capacity kJ/kg/K	3.379
Thermal Conductivity W/m/C	0.42
Coefficient of Thermal Expansion (g/cm <sup>3</sup> )/°C	0.00063
Particulate Cleanliness (NAS1638)	8 or better



## 2.0 ANTI-CORROSION PROPERTIES

Pelagic V18 Hydraulic Control Fluid has been subjected to extensive anti-corrosion testing to ensure compatibility with metals commonly found in Hydraulic Control Systems.

### 2.1 METAL COMPATIBILITY TEST METHOD SUMMARY

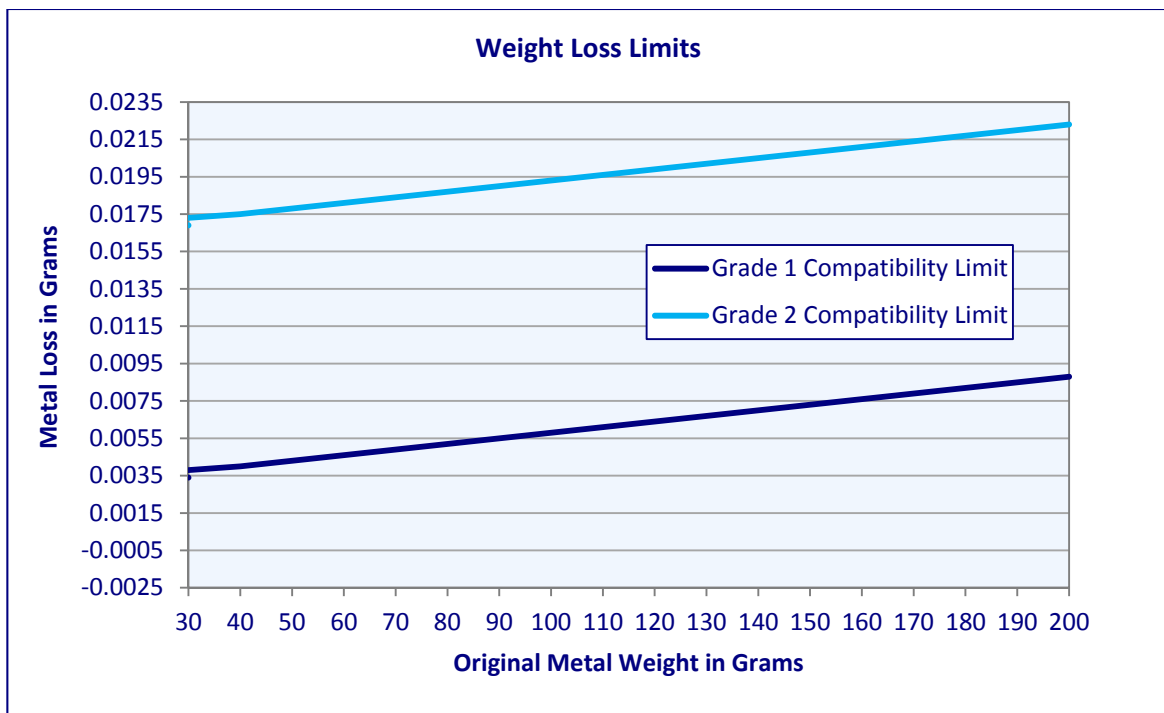
The metal in question is exposed to the test fluid, on a one to one basis, or in a cell as required, at 70°C for 4 weeks, with interim visual results taken after 2 weeks. The samples are examined after the 4-week test period for weight loss to 4 decimal places along with signs of visible corrosion and detrimental effects on the test fluid.

This metal compatibility test regime is designed to identify which metals are largely unaffected by the test fluid and all metals which pass the test regime are considered fully compatible with the fluid in question.

The factors used to determine Grade One compatibility cover 3 main areas.

1. Degree of weight loss in relation to weight of test piece.
2. Effects of test regime on visual appearance of the metal.
3. Effects of test regime and test metal on fluid appearance.

#### 2.12 Graphical Representation of Weight Loss Limits





## 2.2 METAL TEST RESULTS

Weight Loss Data				
Test Metal	Metal Source	Compatibility Grade	Visual Metal Result	Visual Fluid Result
Alloy K500 Z50000	OEM	Grade One	Grade One	Grade One
K500 RND	OEM	Grade One	Grade One	Grade One
17.4 pH	OEM	Grade One	Grade One	Grade One
316/S42	OEM	Grade One	Grade One	Grade One
Elgiloy	OEM	Grade One	Grade One	Grade One
AISI 440C Shear-Seal™*	OEM	Grade One	Grade One	Grade One
316 Bar	OEM	Grade One	Grade One	Grade One
Super Duplex Bar	OEM	Grade One	Grade One	Grade One
440C Spindle	OEM	Grade One	Grade One	Grade One
AMS 5630	OEM	Grade One	Grade One	Grade One
Silicon Nitride Balls	OEM	Grade One	Grade One	Grade One
Zirconia	OEM	Grade One	Grade One	Grade One
Incoloy 825 Bar	Niche	Grade One	Grade One	Grade One
Inconel 625 Bar	Niche	Grade One	Grade One	Grade One
Titanium	Niche	Grade One	Grade One	Grade One
Super Duplex HM8831	Niche	Grade One	Grade One	Grade One
Duplex 9490	Niche	Grade One	Grade One	Grade One
Steel 431	Niche	Grade One	Grade One	Grade One
SS304 Flat Bar	Niche	Grade One	Grade One	Grade One
A4-80 Nuts	Niche	Grade One	Grade One	Grade One
Steel 416/S21 Bar	Niche	Grade One	Grade One	Grade One
Steel 431 Round Bar	Niche	Grade One	Grade One	Grade One
13 Chromium Bar	Niche	Grade One	Grade One	Grade One
17.4.ph Round Bar	Niche	Grade One	Grade One	Grade One
Steel 440c Round Bar	Niche	Grade One	Grade One	Grade One
Monel K400	Niche	Grade One	Grade One	Grade One
Alloy 718 Round bar	OEM	Grade One	Grade One	Grade One
Steel 070M20 BMS	Niche	Grade One	Grade One	Grade One
Galvanised Umbilical	OEM	Grade One	Grade One	Grade One
ASTM-A789	OEM	Grade One	Grade One	Grade One
Super Duplex S32750	OEM	Grade One	Grade One	Grade One
Alloy 718 Bar	OEM	Grade One	Grade One	Grade One
9Cr 1 Mo Alloy 18/22C	OEM	Grade One	Grade One	Grade One
AISI 410 Bar	OEM	Grade One	Grade One	Grade One
Alloy 450 UNS545000	OEM	Grade One	Grade One	Grade One
AISI 4140 Bar	OEM	Grade One	Grade One	Grade One

\*Shear-Seal™ is a registered trademark of Barksdale, Inc. and it is used herein with the consent of Barksdale, Inc.



### 3.0 INDIVIDUAL METAL SEAWATER COMPATIBILITY

This data was compiled using the test protocols employed in the previous section with 0%, 2%, 5% and 10% seawater added to each sample.

Test Metal	Pelagic V18			
	% v/v Seawater Added			
	0%	2%	5%	10%
Inconel 625	Grade One	Grade One	Grade One	Grade One
Incoloy 825	Grade One	Grade One	Grade One	Grade One
Monel K400	Grade One	Grade One	Grade One	Grade One
Stainless Steel 316	Grade One	Grade One	Grade One	Grade One
Stainless Steel 304	Grade One	Grade One	Grade One	Grade One
Duplex 9490	Grade One	Grade One	Grade One	Grade One
S. Duplex (HM8831)	Grade One	Grade One	Grade One	Grade One
Steel 17-4-ph	Grade One	Grade One	Grade One	Grade One
Steel A4-80	Grade One	Grade One	Grade One	Grade One
Titanium	Grade One	Grade One	Grade One	Grade One
13 Chromium	Grade One	Grade One	Grade One	Grade One
Steel 440C	Grade One	Grade One	Grade One	Grade One
Steel 431	Grade One	Grade One	Grade One	Grade One
Steel 416-S21	Grade One	Grade One	Grade One	Grade One
Nickel Copper	Grade One	Grade One	Grade One	Grade One
K500 Z50000 Rev 7	Grade One	Grade One	Grade One	Grade One
Steel 316/S42	Grade One	Grade One	Grade One	Grade One
Elgiloy	Grade One	Grade One	Grade One	Grade One
9 Cr 1 MO (18/22C)	Grade One	Grade One	Grade One	Grade One
AISI410	Grade One	Grade One	Grade One	Grade One
S. Duplex UNS32750	Grade One	Grade One	Grade One	Grade One
Alloy 718	Grade One	Grade One	Grade One	Grade One

#### Notes:

- Testing on a wide range of Mild/Carbon Steels has shown that some of these metal types can be susceptible to seawater corrosion in some instances. Seawater ingress should therefore be minimised where possible.
- Aluminium Bronze materials and base copper metal have variable compatibility and advice should be sought from Niche Products when using such materials.
- New metals are being tested by Niche Products all the time; please contact us for further information and updates.
- Please also refer to the section in this manual titled 'Some Materials to Avoid' for further information on metal incompatibility.



## 4.0 GALVANIC CORROSION PROTECTION

In addition to the single metal and general corrosion data covered elsewhere in this report, Pelagic V18 Hydraulic Control Fluid has also been subjected to extensive Galvanic Corrosion analysis using cells of metal tested in line with TP013 (A). Also on the Digi Galv Corrosion analyser which is a standard test method used in the development of water based Hydraulic control fluids.

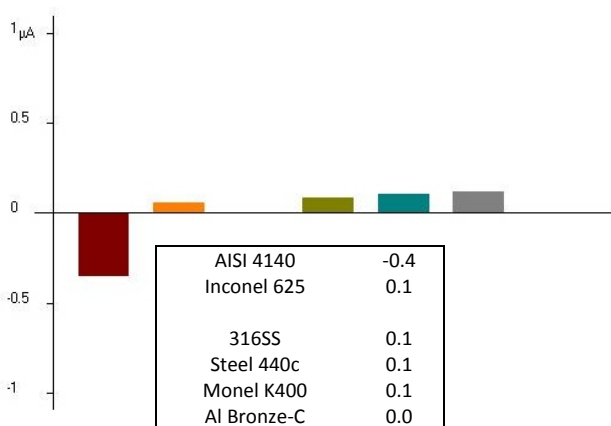
The Digi Galv Corrosion Analyser is a chemical electronics technique that allows the measurement in real time of the galvanic interaction of several metals in a cell. This test is generally conducted at room temperature but can be conducted at higher and lower temperatures if required.

Niche Products have manufactured their own test head for this technology, using metals commonly found in subsea hydraulic systems, and this test head has been used to examine galvanic interactions of 6 metals commonly used in subsea systems, both on the neat fluid and on the neat fluid with 10% Seawater added.

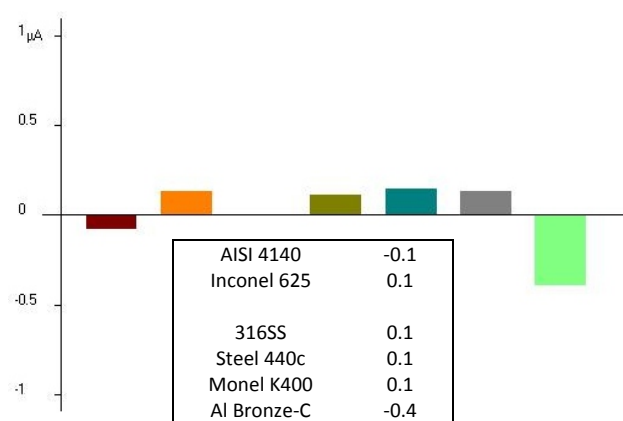
Metals Present in Galvanic Test Head	
AISI 4140 Steel	Monel K400
AISI 440C Steel	Inconel 625
Aluminium Bronze	316 Stainless Steel

### 4.1 RESULTS FROM DIGI GALV GALVANIC CORROSION WORK

Pelagic V18 with 0% Seawater



Pelagic V18 with 10% Seawater



In general, any figure below 5µA is acceptable for any single metal in the cell and considered to represent insignificant galvanic interaction. From the data above we can see that all metals tested, with and without seawater, have figures below the 5µA limit. This data suggest insignificant galvanic effects for all fluids in all instances shown.





## 5.0 SEAL AND ELASTOMER MATERIAL COMPATIBILITY

### 5.1 TEST METHOD SUMMARY

Seal testing is conducted on commercially available seal types and seals submitted by OEM's and potential customers.

Seals are exposed (in triplicate) to temperatures of 70°C for 1 week, both in the liquid and vapour phase of the fluid of choice.

Shore hardness and accurate weight measurements are conducted on the seals before and after exposure and any fluctuations are noted.

Any significant change in shore hardness and any weight gain/loss (swell/shrinkage) is recorded and the material is then given a compatibility grading as outlined below.

#### 5.12 Criteria for Grading Test Results

Seal Swell/Shrinkage Results		Relevant Fail Criteria
<-5% average Swell	Further Testing Required	Significant change in shore hardness
-5 to -2% average Swell	Grade 2 Pass	Signs of visual degradation of material
-2 to 4% average Swell	Grade One Compatible	Signs of elastomeric debris in test fluid
4% to 15% average Swell	Grade 2 Testing Pass	Signs of fluid degradation
>15% average Swell	Further Testing Required	Any other relevant factors noted

#### **Important Notes:**

- Results are based on a median of the 3 elastomeric materials tested.
- In cases where insufficient quantities of seals to conduct testing in triplicate and/or in both vapour and liquid phase exist, priority is given to liquid phase testing.
- Under circumstances where seal types submitted by OEM's are not sufficiently large to gain an accurate Shore Hardness reading, the results for shore hardness are stated as 'Non Measurable'.
- A Grade 2 compatibility profile is a fairly common result for OEM submitted seal types, as they tend to submit only those materials that have the potential to react with hydraulic fluids.



## 5.2 SUMMARY OF RESULTS

Seal/ Elastomer Type	Source	Test Phase	% Swell (average)	Hardness change	Any Other Issues	Overall Grading
Nylon 11 Bar	Niche	Liquid	Grade One	Pass	None	Grade One
Nylon 11 Bar	Niche	Vapour	Grade One	Pass	None	Grade One
PEEK	Niche	Liquid	Grade One	Pass	None	Grade One
PEEK	Niche	Vapour	Grade One	Pass	None	Grade One
Hytrel 6356	Niche	Liquid	Grade One	Pass	None	Grade One
Hytrel 6356	Niche	Vapour	Grade One	Pass	None	Grade One
Umbilical Hose Liner	OEM	Liquid	Grade One	Pass	None	Grade One
Umbilical Hose Liner	OEM	Vapour	Grade One	Pass	None	Grade One
Viton	Niche	Liquid	Grade One	Pass	None	Grade One
Viton	Niche	Vapour	Grade One	Pass	None	Grade One
EPDM	Niche	Liquid	Grade One	Pass	None	Grade One
EPDM	Niche	Vapour	Grade One	Pass	None	Grade One
Silicone	Niche	Liquid	Grade One	Pass	None	Grade One
Silicone	Niche	Vapour	Grade One	Pass	None	Grade One
PTFE	Niche	Liquid	Grade One	Pass	None	Grade One
PTFE	Niche	Vapour	Grade One	Pass	None	Grade One
NBR Nitrile 70	Niche	Liquid	Grade One	Pass	None	Grade One
NBR Nitrile PB80	OEM	Liquid	Grade Two	NM	None	Grade Two
NBR Nitrile 90	OEM	Vapour	Grade Two	Pass	None	Grade Two
Viton KFM-FR 10/80	OEM	Liquid	Grade One	NM	None	Grade One
Viton KFM-FR 10/80	OEM	Vapour	Grade One	NM	None	Grade One
Delrin back up ring 15-081496-13	OEM	Liquid	Grade One	NM	None	Grade One
Chemraz O-ring 20-080119-21	OEM	Liquid	Grade One	NM	None	Grade One
88-081007-01	OEM	Liquid	Grade Two	NM	None	Grade Two
Viton O-ring 20-080009-23	OEM	Liquid	Grade One	NM	None	Grade One
70 shore O-ring 200080009-11	OEM	Liquid	Grade One	NM	None	Grade One
200080009-11	OEM	Vapour	Grade One	NM	None	Grade One

\*NM = not measurable



## 6.0 LUBRICATION & ANTI-WEAR

### 6.1 FALEX LUBRICITY AND ANTI-WEAR TEST DATA

Lubrication testing on Pelagic V18 was conducted using Falex Lubricity Test equipment.

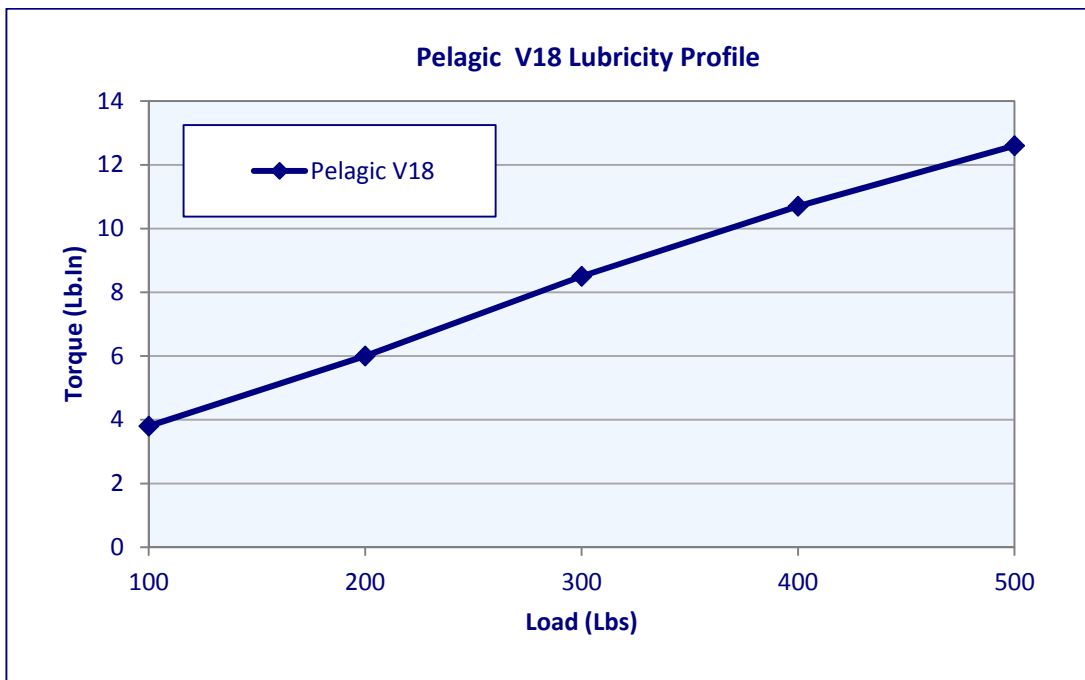
All testing was conducted independently on samples submitted by Niche Product Laboratories.

The Falex tester measures the torque experienced on a rotating test pin submerged in the test fluid, as it is subjected to increasing load. The load on the pin is increased at 100lb increments and the torque measured at each load increment. On reaching 500lb load, the load is held for 30 minutes and the level of wear on the test pin recorded in units of 'wear teeth'.

A good lubricant is one that shows comparatively low torque and a low number of wear teeth.

Pelagic V18 Falex Test Data	
Test Load	Torque (Lb.In)
100 Lbs.	3.8
200 Lbs.	6.0
300 Lbs.	8.5
400 Lbs.	10.7
500 Lbs	12.6
500 Lbs (30mins)	10.1
Total No Wear Teeth	0

#### 6.11 Graphical Results of Testing





## **7.0 SOME MATERIALS TO AVOID**

*Listed below are several materials that have the potential to be incompatible with water glycol hydraulic fluids in general.*

- Cadmium Plating
- Zinc Plating
- Aluminium and Aluminium rubbing contacts
- Some Zinc & Aluminium Alloys - samples should be submitted for further test.
- Electroplated components - samples should be submitted for further test.
- Copper Metal - samples should be submitted for further test.
- Viton Impregnated Cotton
- Porous seal materials and gaskets (e.g. paper or cork)
- Impregnated paper type Filter Elements
- Paint coatings - samples should be submitted for further test

Please contact us if you require more specific information on any of these materials.

## **8.0 BACTERIAL PROTECTION**

Some Hydraulic Fluids sold on the market contain organic biocides designed to restrict growth of fungal and bacterial cultures.

Pelagic V18 Hydraulic Control Fluid offers a similar level of fungal and biocidal protection, to that generally offered by Hydraulic Fluids using conventional biocides, but with several key advantages.

Pelagic V18 Hydraulic Control Fluid does not contain a conventional organic biocide that can be consumed under prolonged bacterial and fungal attack. Instead, Pelagic V18 contains an inorganic bacterial and fungal growth inhibitor that prevents bacteria and fungus growing, rather than killing cultures as they grow.

This technology has several key advantages in that it is not consumed as part of its protective mechanism, leaving it better able to defend the fluid in the longer term. In addition, this type of protection does not involve killing bacteria and fungus, hence is of low order toxicity to marine life.

A further advantage of this technology includes avoidance of possible employee sensitisation to conventional biocidal additives, bringing advantages in terms of employee health and safety.

## **9.0 FLUID CLEANLINESS**

Pelagic V18 Hydraulic Control Fluid is filtered to NAS 1638 Class 8 (ISO 4406 19/17/14) during manufacture and great care is taken during filling to ensure minimum particulate contamination.



## **10.0 PACKAGING OPTIONS**

Pelagic V18 Hydraulic Control Fluid is available for purchase in the following pack sizes:

- 210 Kilo L-Ring plastic drums
- 1050 Kilo New IBC containers (palletised)
- 2,200 Litre Bulk 'Tote' Tanks suitable for transport offshore.
- Bulk Road Tanker.

## **11.0 FLUID MAINTENANCE**

Niche Products operate a fluid sampling system, where purchasing assets are encouraged to submit regular fluid samples to our laboratories for analysis of fluid properties and advice on fluid integrity.

Niche Products can offer advice on sampling on board and can also offer free sample bottles and labels for this purpose.

Niche Products can also offer a fluid management system to customers which is designed to clean, circulate and monitor fluid integrity on board. Please contact our technical department for further information.

## **12.0 CONTACT DETAILS**

Please feel free to contact our Technical or Sales Department at:

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