



# Campbell Shillinglaw Lau Ltd

## 金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-20 SLIDE ON FLANGE JOINT WITH STEEL ANGLE EXTERNAL STIFFENER FOR  
DUCT SYSTEM (CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R1



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-20 slide on steel angle stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R1\_A and the detail set up for the deflection measurement is as shown in 180329R1\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R1\_C, were constructed:

Specimen: 800 mm (W) x 300 mm (H) x 3000 mm (L)  
(Rated to J2 high pressure)

The test sample consists of a rectangular duct (0.8mm thick) which was prefabricated by pittsburg lock seam, 180329R1\_D, and ready for duct section assembly.

The YF-20 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R1\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-20 slide on flange was fastened to the duct section to form a cross joint by spot welding, and external stiffener by mechanical rivet at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp are as shown in 180329R1\_E.

4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	24.69	25.95	26.58	27.12	26.33	25.83	24.82	1.7	3.2
Leakage rate L/s	0	0.17	0.24	0.28	0.25	0.18	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in “Section 4 Results”, test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY



Leslie LAU  
 For and on behalf of  
 Campbell Shillinglaw Lau Ltd.



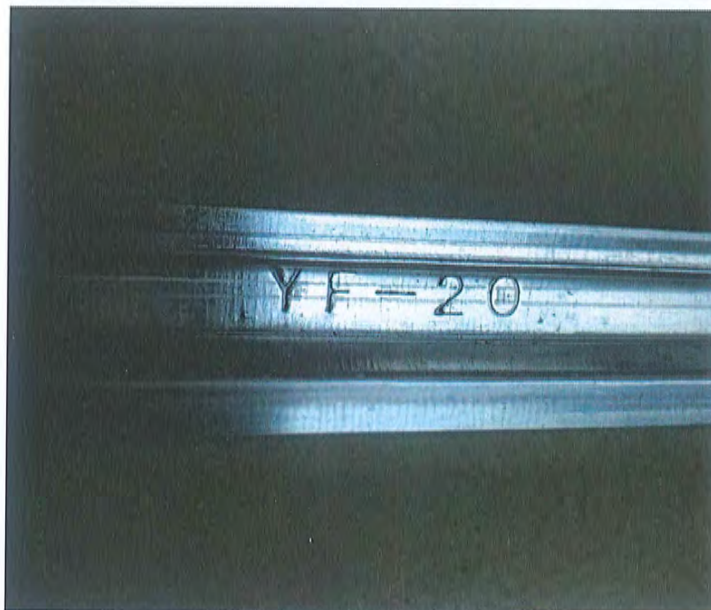
## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-20 Slide on Flange (Rated to J2 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-20' CORNER PIECE



'YF-20' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
Title : YF-20 Slide on Flange (Rated to J2 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

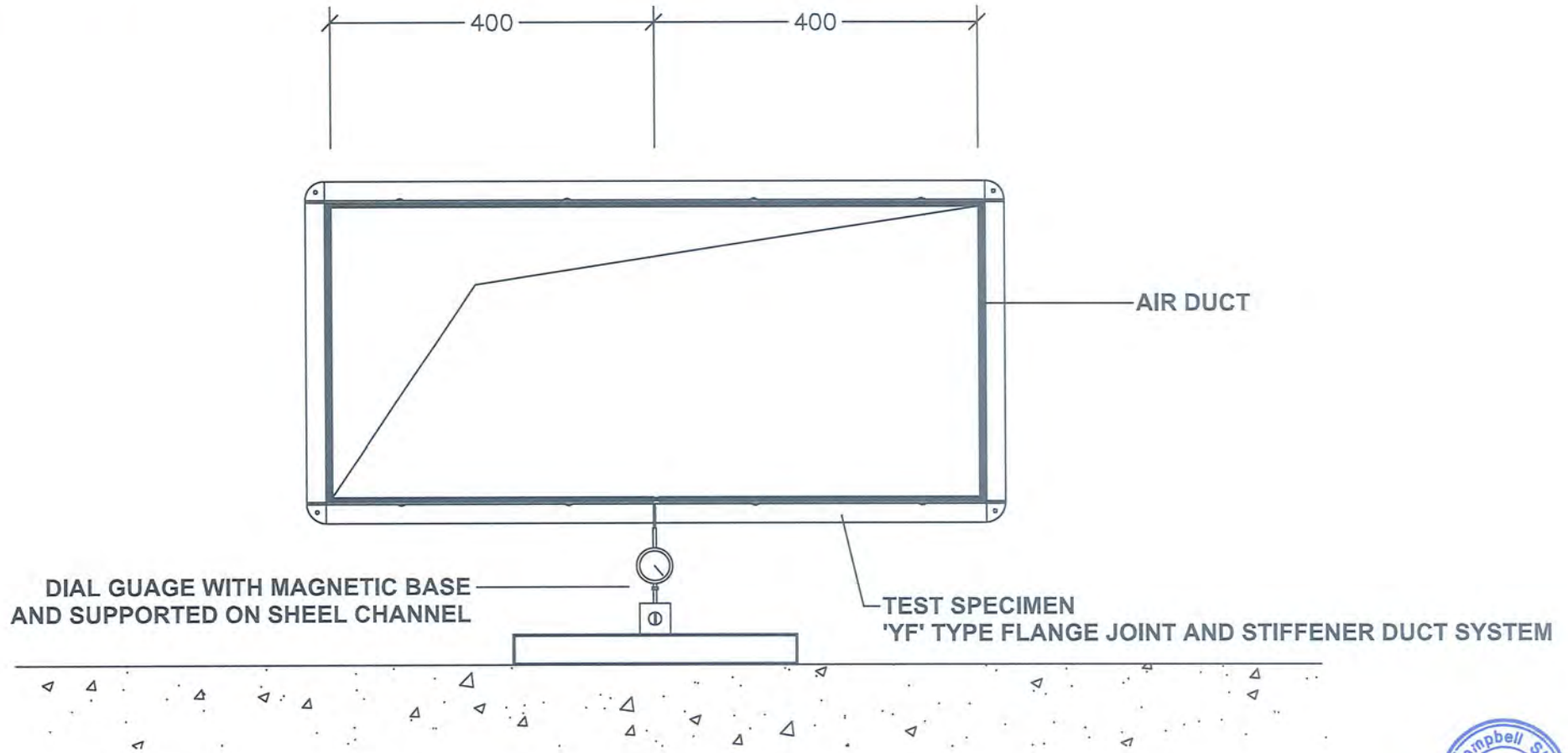
- |                                    |                                |
|------------------------------------|--------------------------------|
| 1. Duct dimension                  | 800(W) x 300(H) x 3000(L)      |
| 2. Pressure classification         | C                              |
| 3. Test static pressure            | 2000Pa                         |
| 4. Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. Surface area of duct under test | 6.6 sq. meter                  |
| 6. Maximum permitted leakage * 40% | 1.11 litres / sec.             |

Please refer drawing for the configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
800 x 300	2200	3000	6.6



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

Scale: NTS

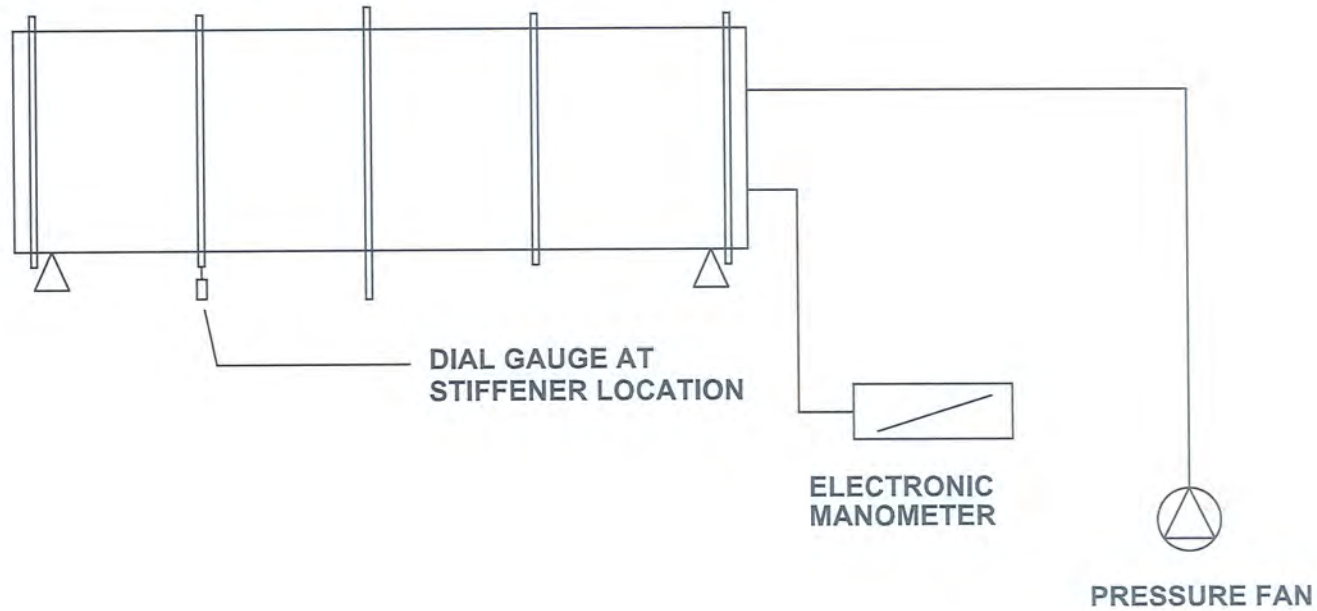
Date: 03/18

Dwg No: 180329R1\_A

 **Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up

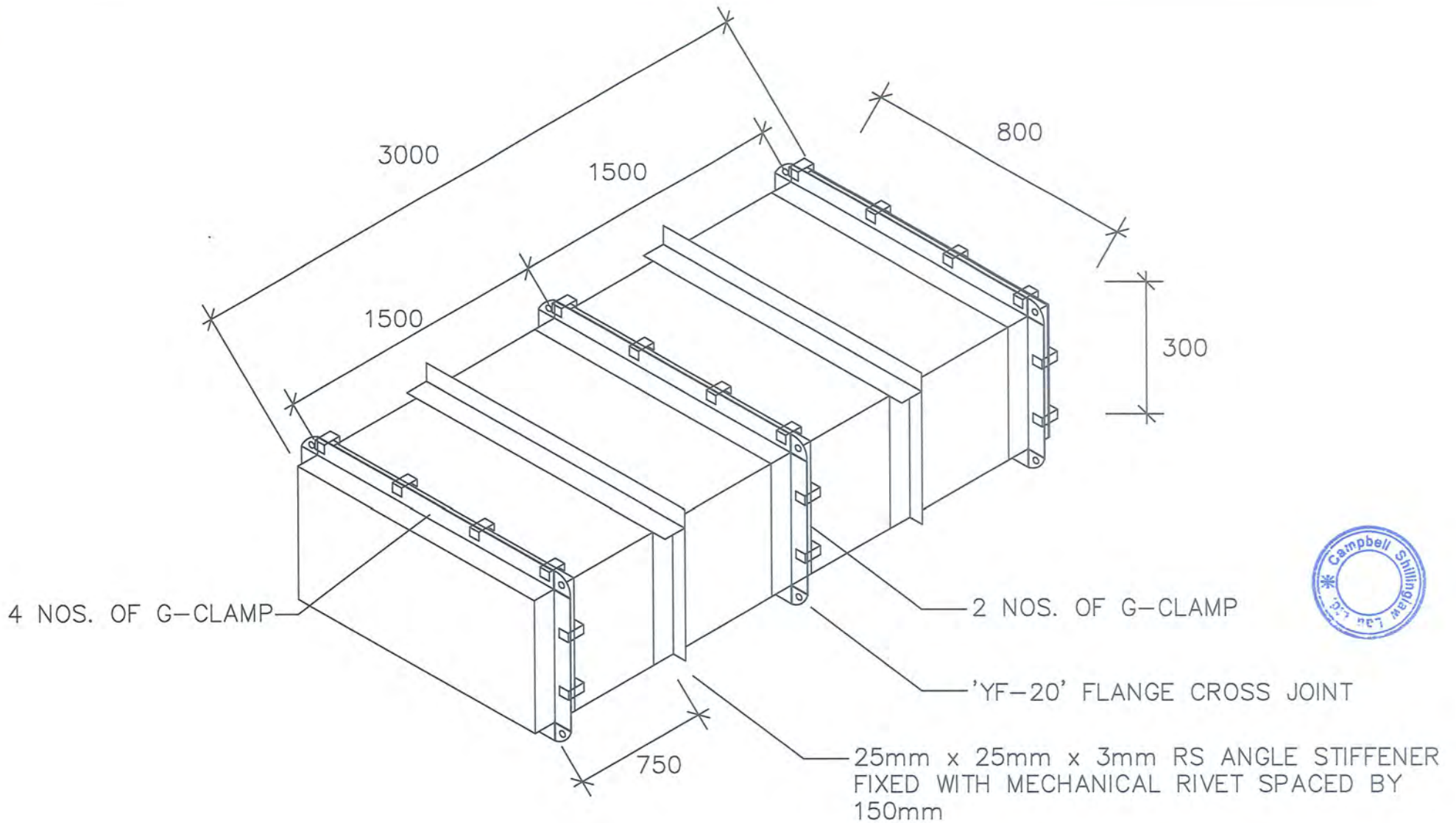
Scale: NTS

Date: 03/18

Dwg No: 180329R1\_B

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Title: Specimen of Size 3000mm(L) x 800mm(W) x 300mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R1\_C

 **Campbell Shillinglaw Lau Ltd.**

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

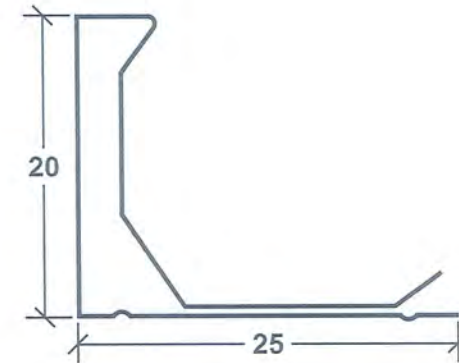
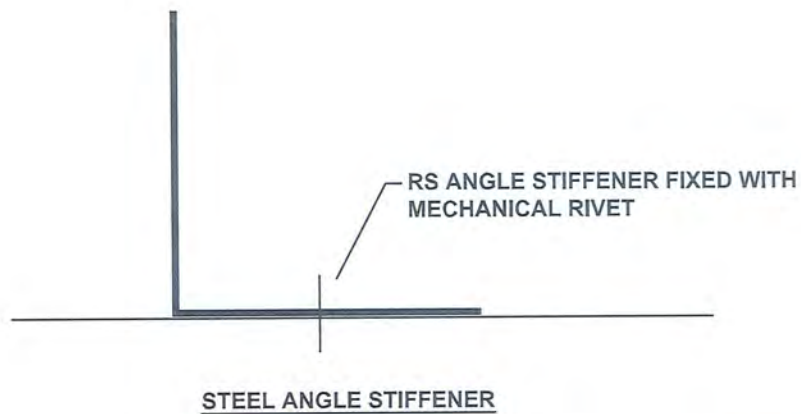
Scale: NTS

Date: 03/18

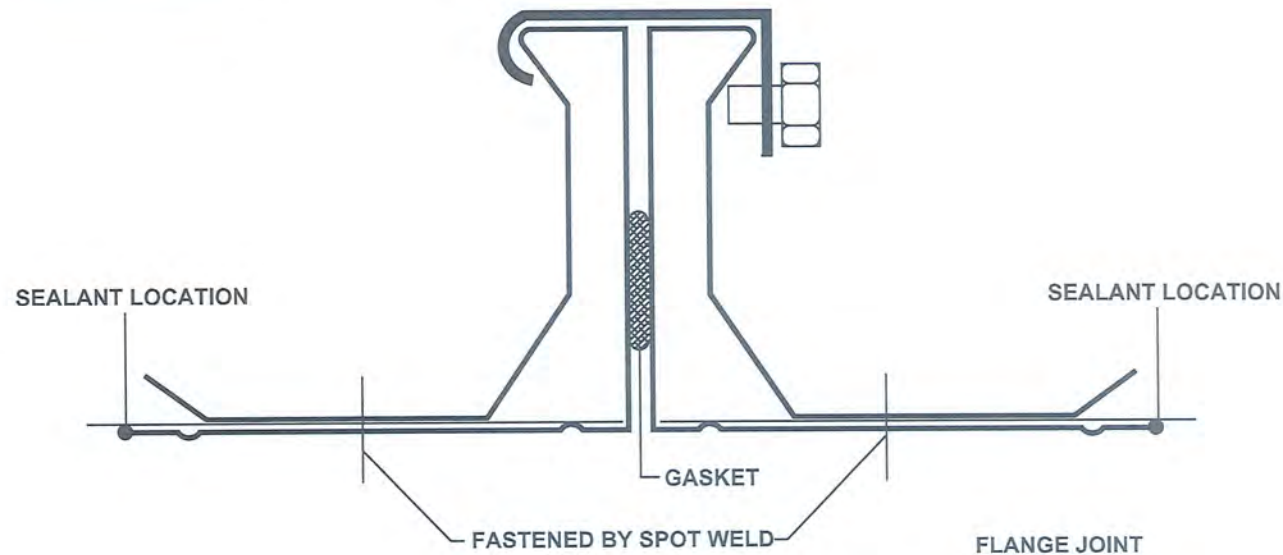
Dwg No: 180329R1\_D

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YF-20 FLANGE



Title: Detail of the Flange Joint (YF-120) & Steel Angle Stiffener

Scale: NTS

Date: 03/18

Dwg No: 180329R1\_E

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REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-20 SLIDE ON FLANGE AS EXTERNAL STIFFENER FOR DUCT SYSTEM  
(CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R2



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-20 slide on flange stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R2\_A and the detail set up for the deflection measurement is as shown in 180329R2\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R2\_C, were constructed:

Specimen: 800 mm (W) x 300 mm (H) x 3000 mm (L)  
(Rated to J2 high pressure)

The test sample consists of a rectangular duct (0.8mm thick) which was prefabricated by pittsburg lock seam, 180329R2\_D, and ready for duct section assembly.

The YF-20 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R2\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-20 slide on flange was fastened to the duct section to form a cross joint and external stiffener by spot welding at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp are as shown in 180329R2\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	40.55	41.13	42.11	42.58	42.08	41.16	40.70	1.5	3.2
Leakage rate L/s	0	0.21	0.28	0.32	0.27	0.20	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

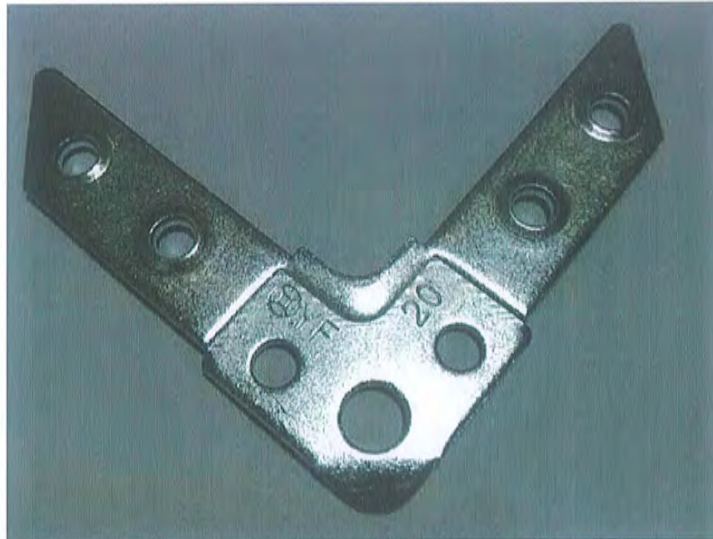
Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



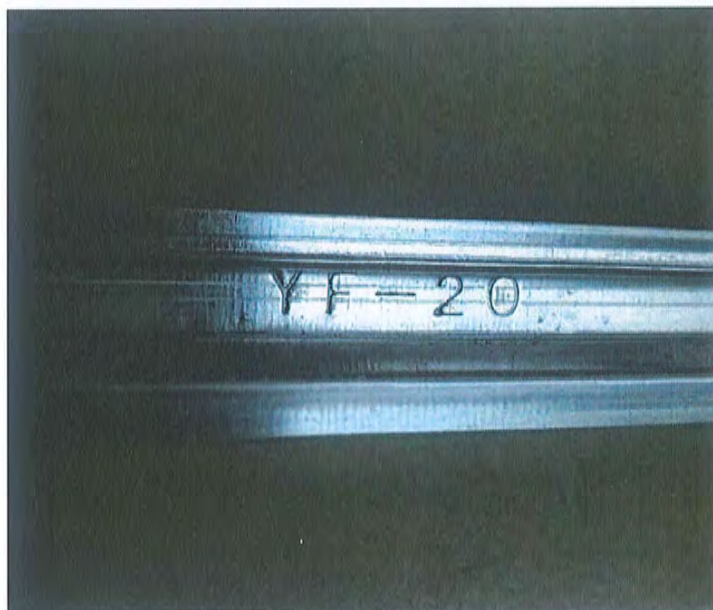
## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-20 Slide on Flange (Rated to J2 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-20' CORNER PIECE



'YF-20' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-20 Slide on Flange (Rated to J2 High Pressure)  
 Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

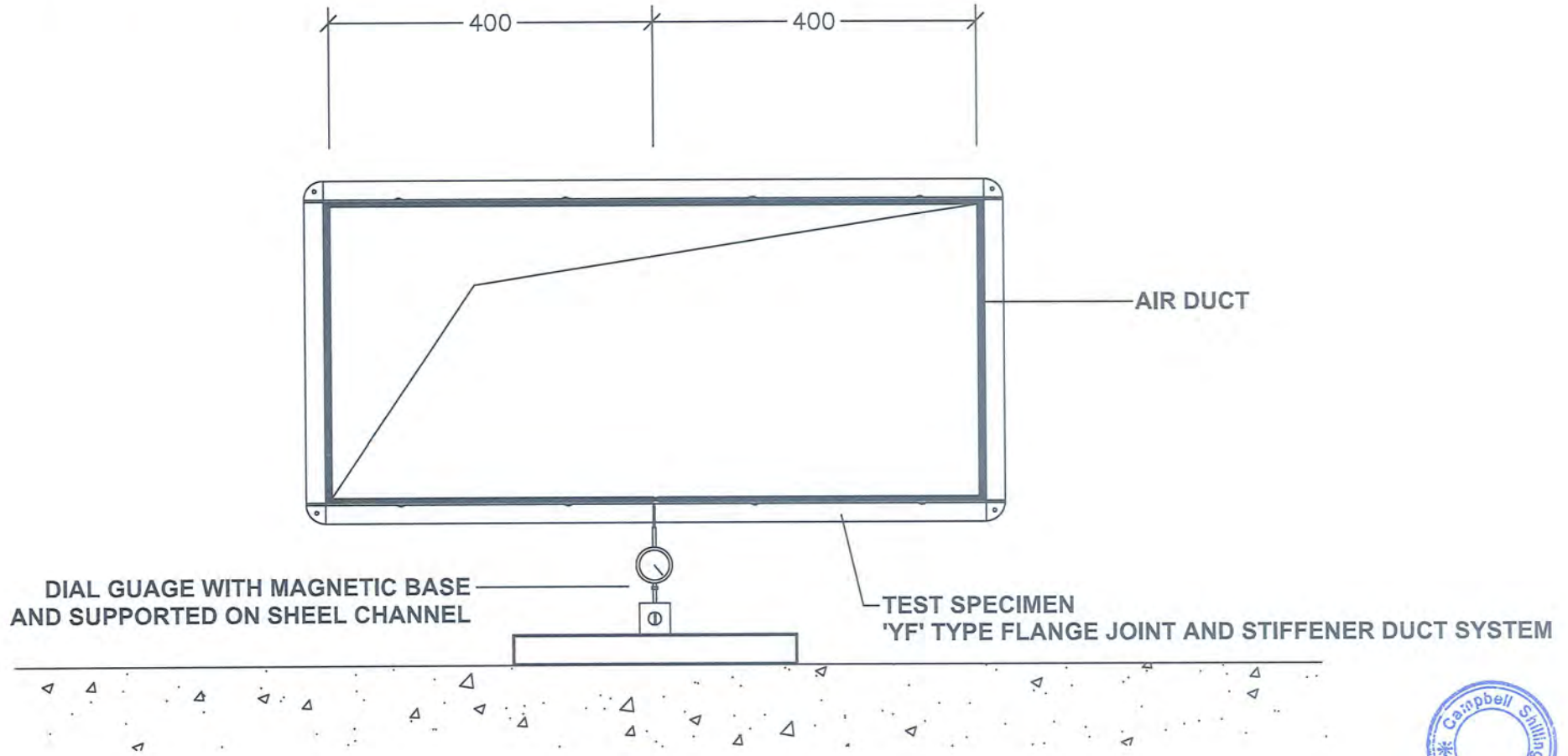
- |    |                                 |                                |
|----|---------------------------------|--------------------------------|
| 1. | Duct dimension                  | 800(W) x 300(H) x 3000(L)      |
| 2. | Pressure classification         | C                              |
| 3. | Test static pressure            | 2000Pa                         |
| 4. | Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. | Surface area of duct under test | 6.6 sq. meter                  |
| 6. | Maximum permitted leakage * 40% | 1.11 litres / sec.             |

Please refer drawing for the configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
800 x 300	2200	3000	6.6



**DETAILED SETUP FOR DEFLECTION MEASUREMENT**



**Title: Detailed Setup for Deflection Measurement**

**Scale: NTS**

**Date: 03/18**

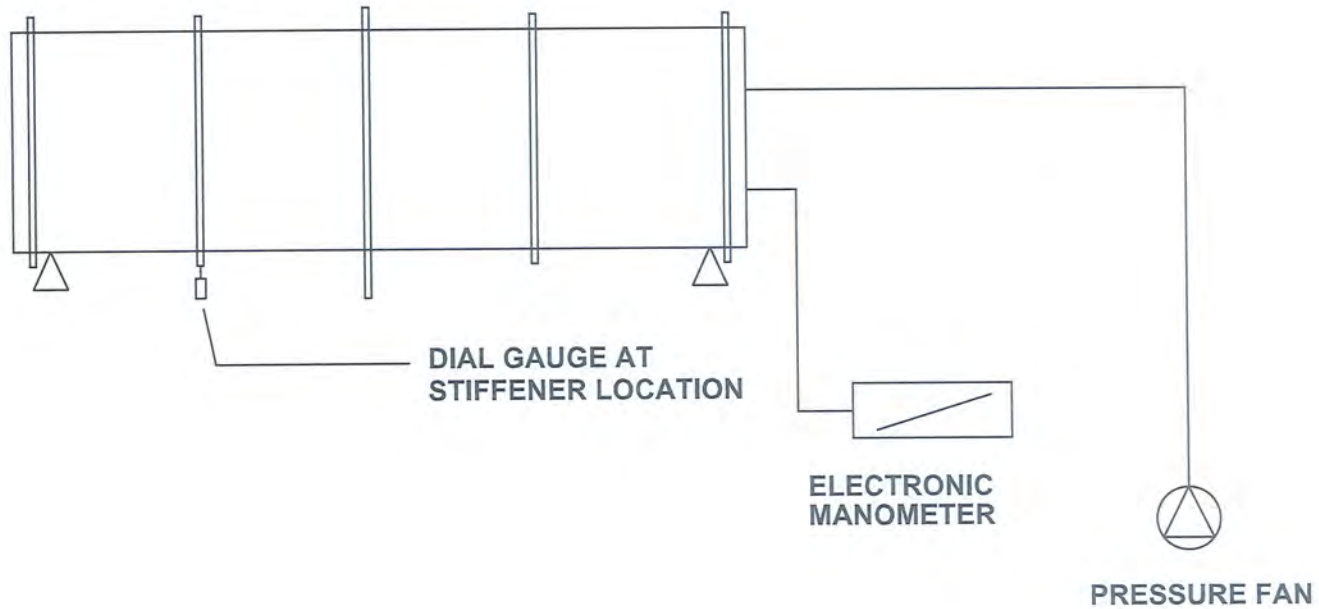
**Dwg No: 180329R2\_A**

**Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up

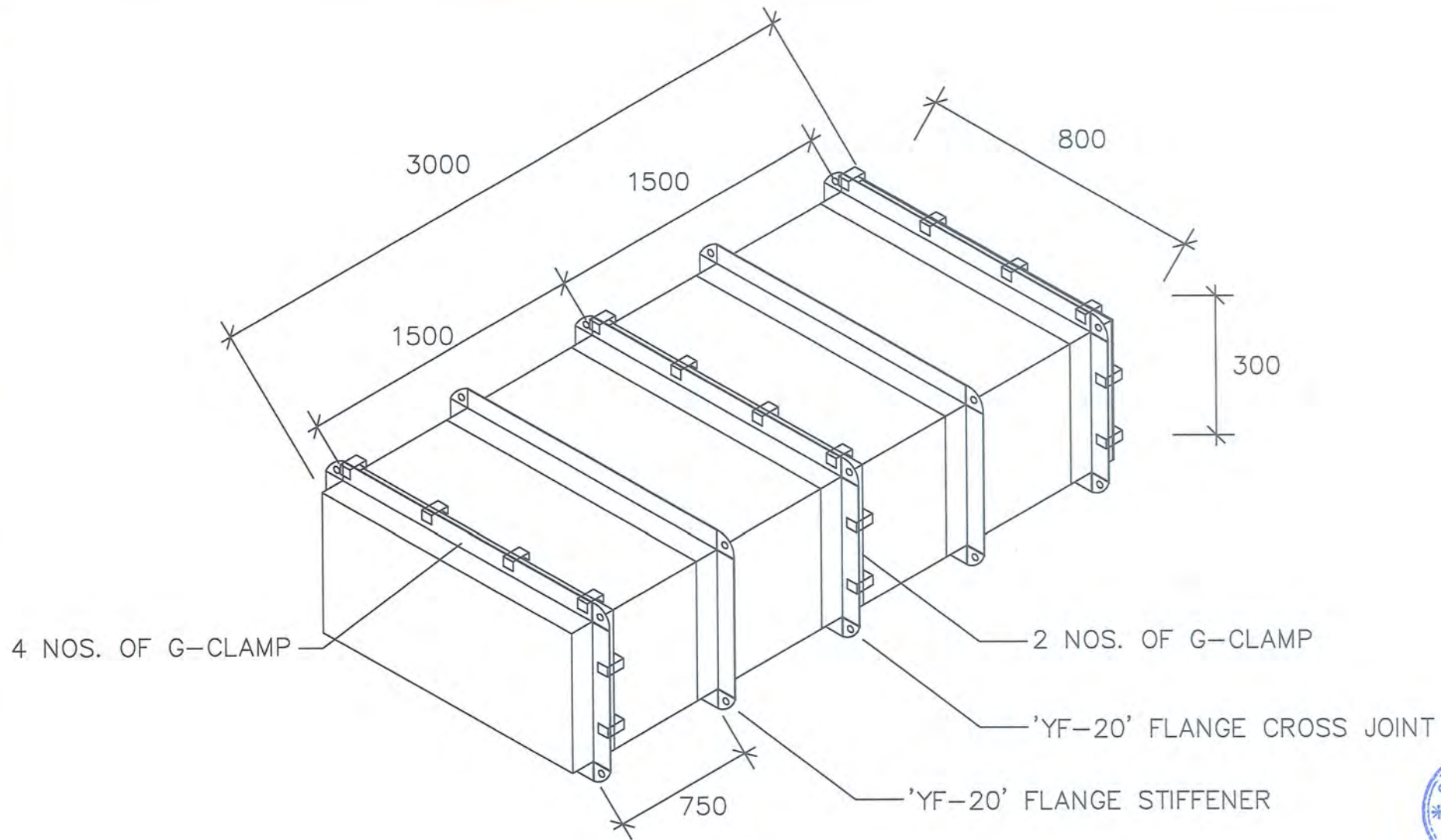
Scale: NTS

Date: 03/18

Dwg No: 180329R2\_B

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consent.



Title: Specimen of Size 3000mm(L) x 800mm(W) x 300mm(H) - High Pressure

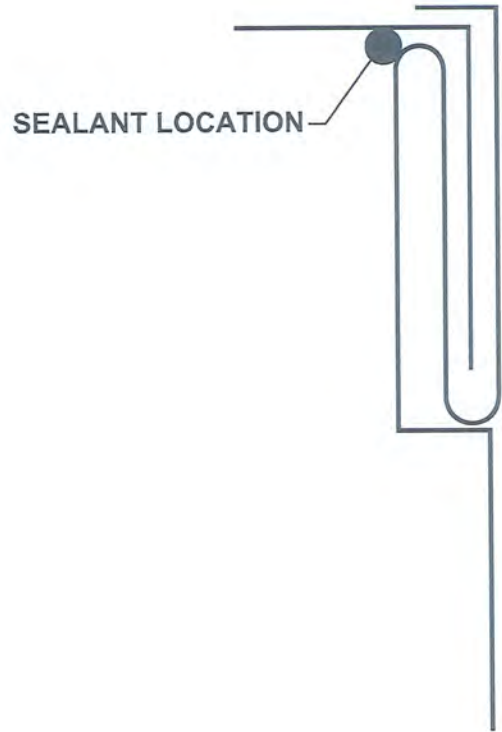
Scale: NTS

Date: 03/18

Dwg No: 180329R2\_C

 **Campbell Shillinglaw Lau Ltd.**

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

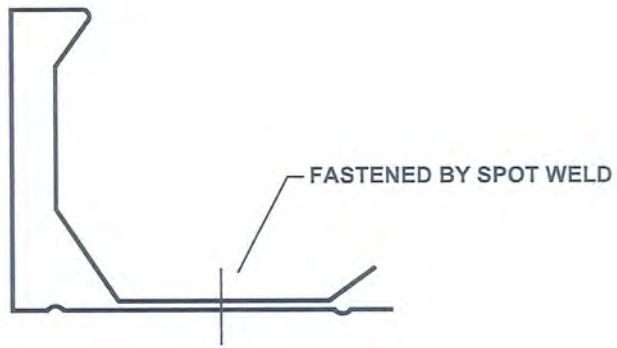
Scale: NTS

Date: 03/18

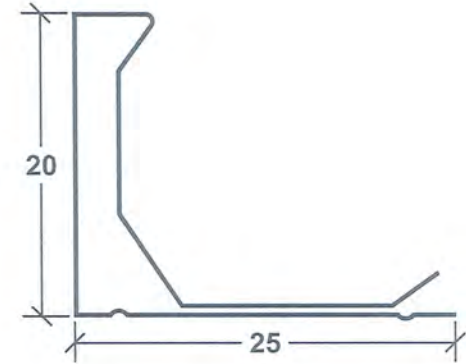
Dwg No: 180329R2\_D

 **Campbell Shillinglaw Lau Ltd.**

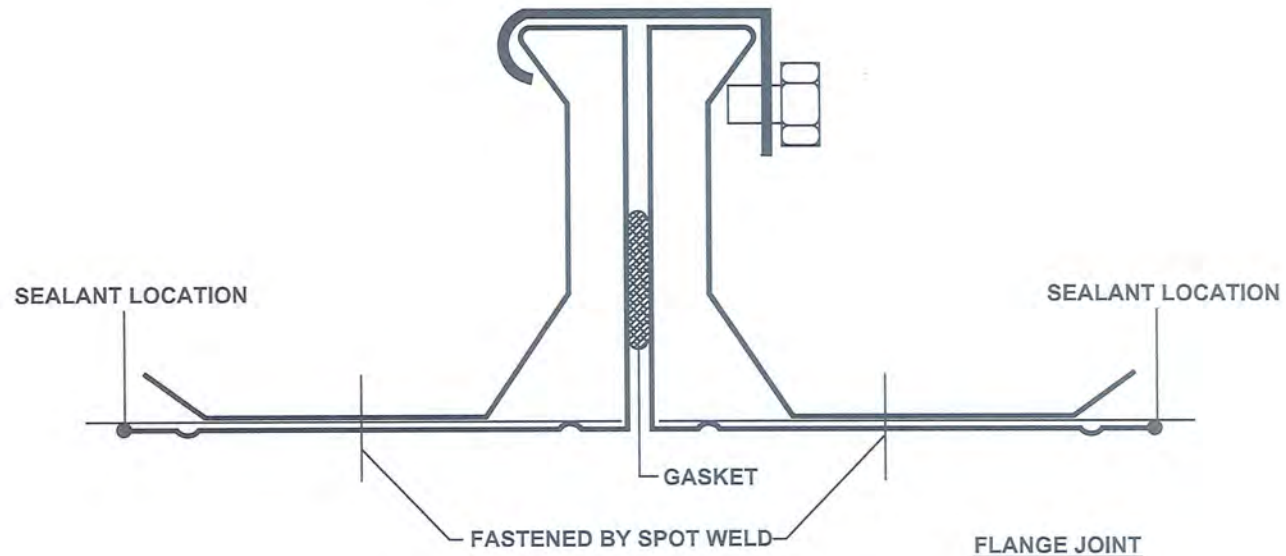
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FLANGE STIFFENER



YF-20 FLANGE



FLANGE JOINT



Title: Detail of the Flange Joint (YF-20) & Flange Stiffener (YF-20)

Scale: NTS

Date: 03/18

Dwg No: 180329R2\_E

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**Campbell Shillinglaw Lau Ltd**  
金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-30 SLIDE ON FLANGE JOINT WITH STEEL ANGLE EXTERNAL STIFFENER FOR  
DUCT SYSTEM (CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018  
DATE OF TEST : 16<sup>TH</sup> MARCH, 2018  
REPORT BY : MR. LESLIE LAU (CSLL)  
TESTED BY : MR. HANG YUEN (CSLL)  
SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.  
TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG  
OUR REF. : CSLL009-2018/180329R3



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-30 slide on steel angle stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R3\_A and the detail set up for the deflection measurement is as shown in 180329R3\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R3\_C, were constructed:

Specimen: 1000 mm (W) x 350 mm (H) x 3000 mm (L)  
(Rated to J3 high pressure)

The test sample consists of a rectangular duct (0.8mm thick) which was prefabricated by pittsburg lock seam, 180329R3\_D, and ready for duct section assembly.

The YF-30 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R3\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-30 slide on flange was fastened to the duct section to form a cross joint by spot welding, and external stiffener by mechanical rivet at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp are as shown in 180329R3\_E.

4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	24.78	25.82	26.98	27.59	26.86	26.10	24.85	2.1	4.0
Leakage rate L/s	0	0.15	0.22	0.33	0.24	0.15	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

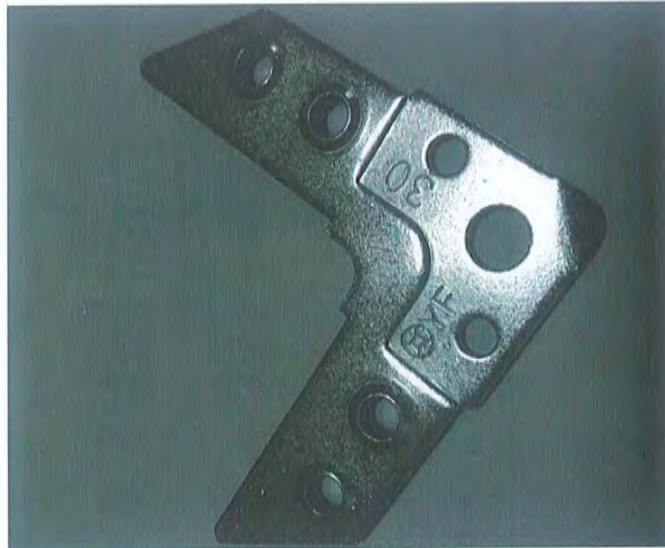
Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-30 Slide on Flange (Rated to J3 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-30' CORNER PIECE



'YF-30' FLANGE CROSS JOINT





## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-30 Slide on Flange (Rated to J3 High Pressure)  
 Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

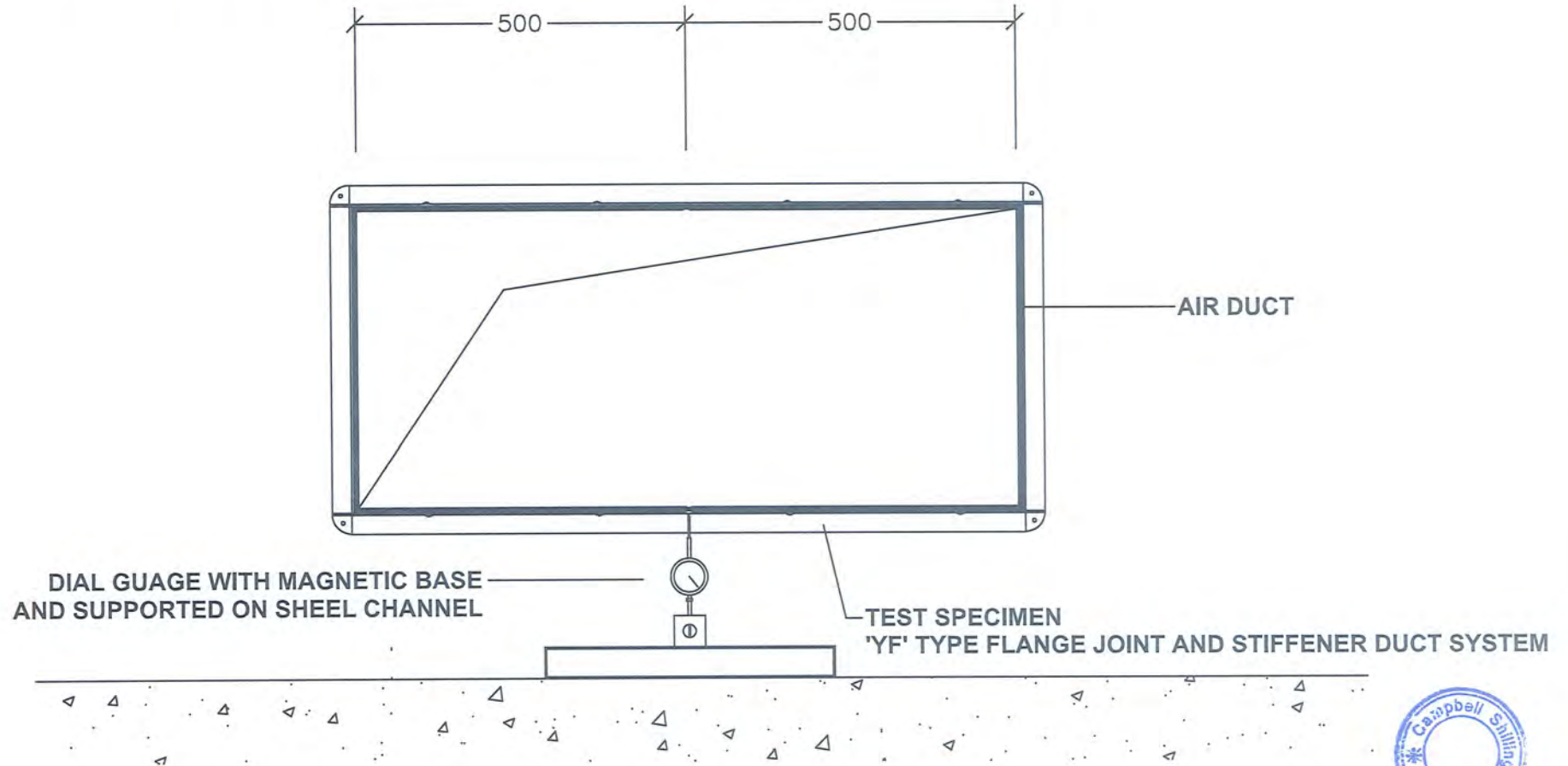
- |    |                                 |                                |
|----|---------------------------------|--------------------------------|
| 1. | Duct dimension                  | 1000(W) x 350(H) x 3000(L)     |
| 2. | Pressure classification         | C                              |
| 3. | Test static pressure            | 2000Pa                         |
| 4. | Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. | Surface area of duct under test | 8.1 sq. meter                  |
| 6. | Maximum permitted leakage * 40% | 1.36 litres / sec.             |

Please refer drawing for the configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
1000 x 350	2700	3000	8.1



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

Scale: NTS

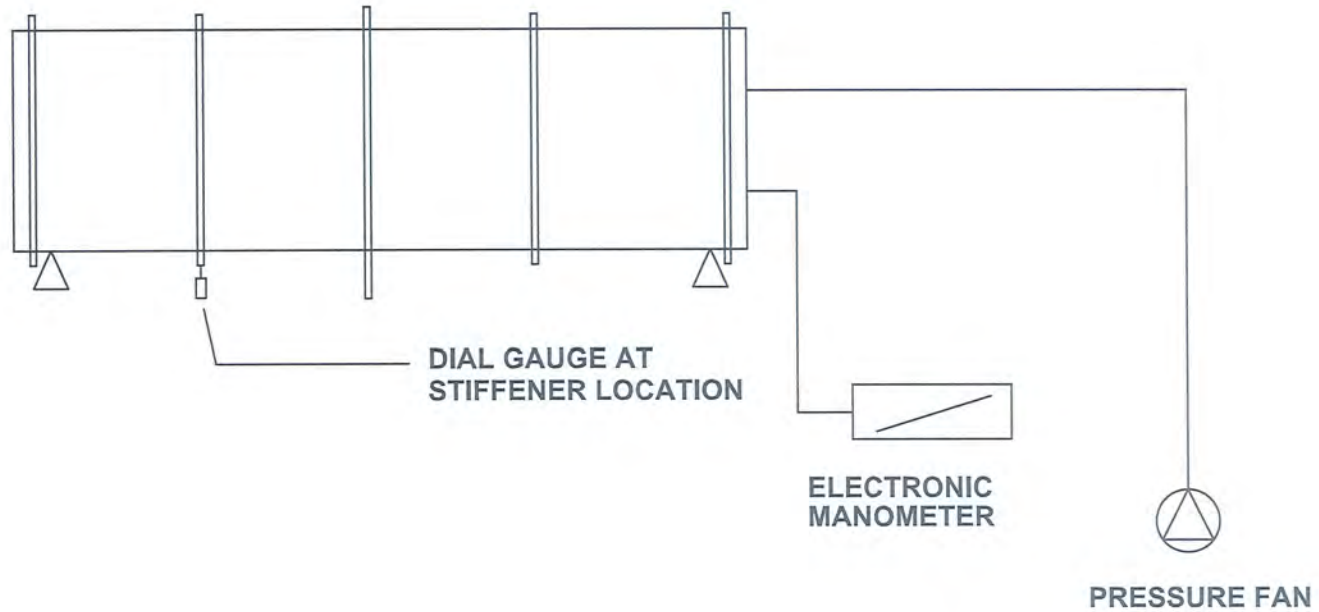
Date: 03/18

Dwg No: 180329R3\_A

 **Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up

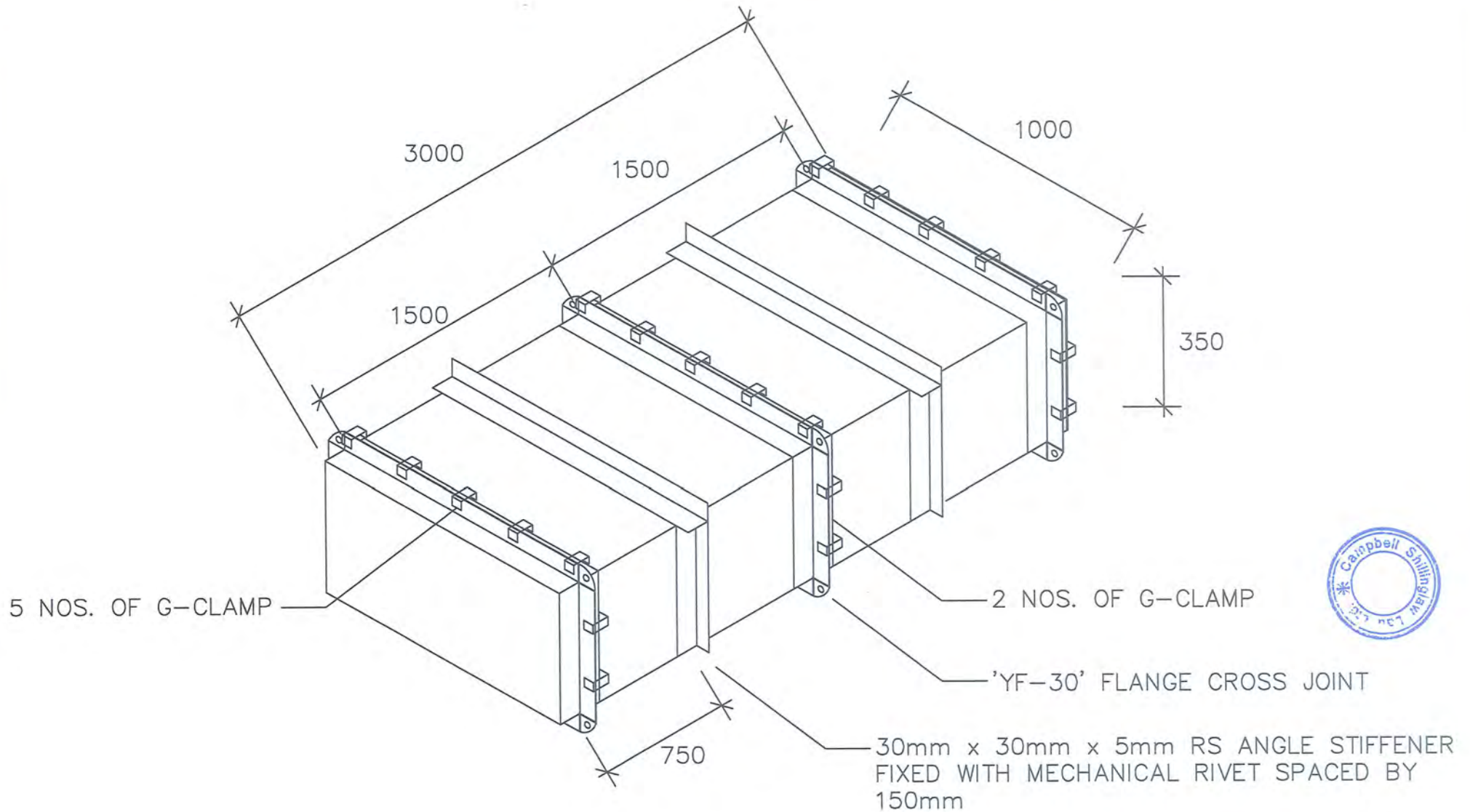
Scale: NTS

Date: 03/18

Dwg No: 180329R3\_B

 **Campbell Shillinglaw Lau Ltd.**

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Title: Specimen of Size 3000mm(L) x 1000mm(W) x 350mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R3\_C

 **Campbell Shillinglaw Lau Ltd.**

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

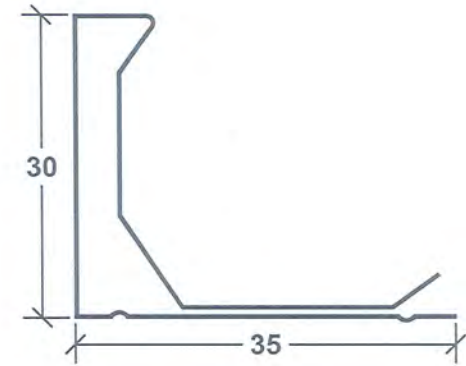
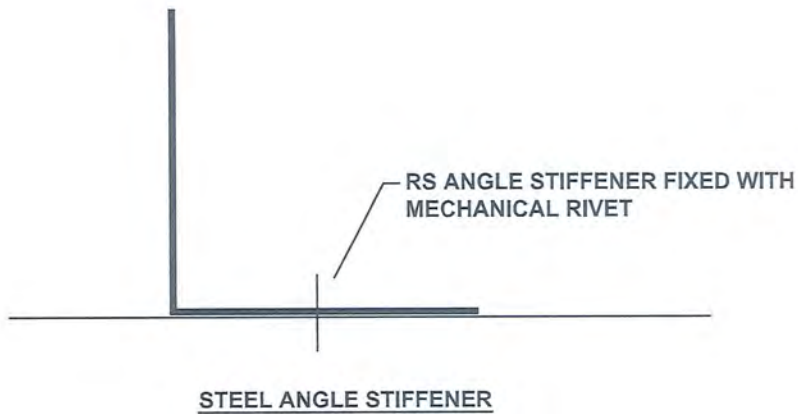
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Date: 03/18

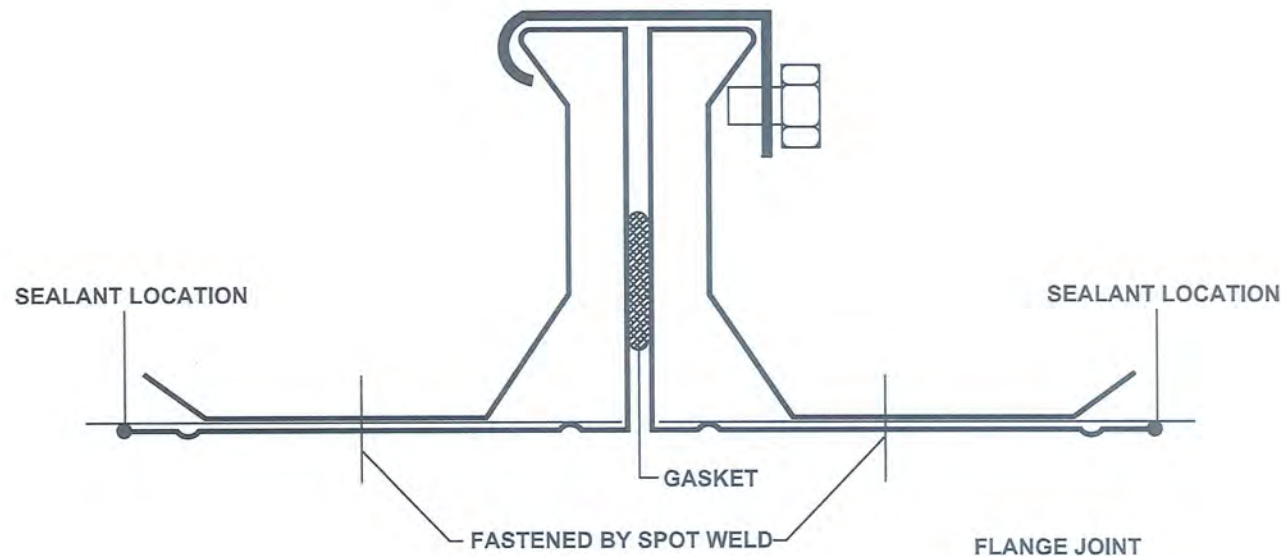
Dwg No: 180329R3\_D

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YF-30 FLANGE



Title: Detail of the Flange Joint (YF-30) & Steel Angle Stiffener

Scale: NTS

Date: 03/18

Dwg No: 180329R3\_E

**Campbell Shillinglaw Lau Ltd.**

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REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-30 SLIDE ON FLANGE AS EXTERNAL STIFFENER FOR DUCT SYSTEM  
(CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R4



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-30 slide on flange stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R4\_A and the detail set up for the deflection measurement is as shown in 180329R4\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R4\_C, were constructed:

Specimen: 1000 mm (W) x 350 mm (H) x 3000 mm (L)  
(Rated to J3 high pressure)

The test sample consists of a rectangular duct (0.8mm thick) which was prefabricated by pittsburg lock seam, 180329R4\_D, and ready for duct section assembly.

The YF-30 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R4\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-30 slide on flange was fastened to the duct section to form a cross joint and external stiffener by spot welding at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp are as shown in 180329R4\_E.





4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	35.58	36.62	38.14	38.65	38.35	36.90	35.91	2.5	4.0
Leakage rate L/s	0	0.18	0.23	0.36	0.22	0.16	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

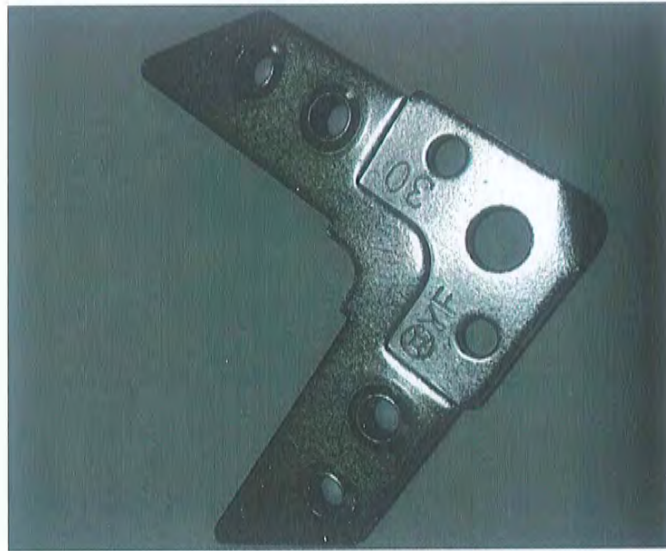
Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-30 Slide on Flange (Rated to J3 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-30" CORNER PIECE



'YF-30' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
Title : YF-30 Slide on Flange (Rated to J3 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

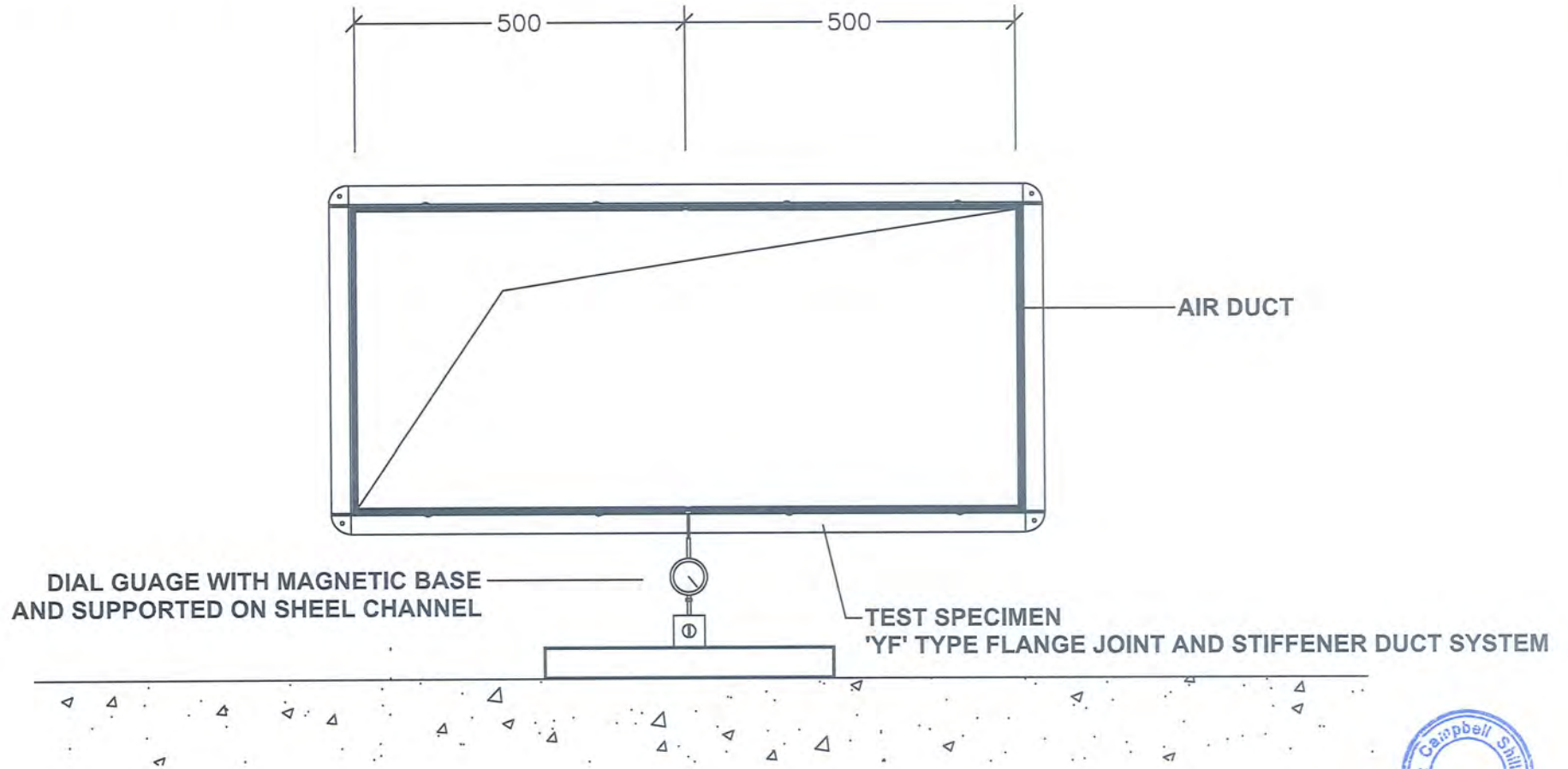
- |                                    |                                |
|------------------------------------|--------------------------------|
| 1. Duct dimension                  | 1000(W) x 350(H) x 3000(L)     |
| 2. Pressure classification         | C                              |
| 3. Test static pressure            | 2000Pa                         |
| 4. Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. Surface area of duct under test | 8.1 sq. meter                  |
| 6. Maximum permitted leakage * 40% | 1.36 litres / sec.             |

Please refer drawing for the configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
1000 x 350	2700	3000	8.1



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

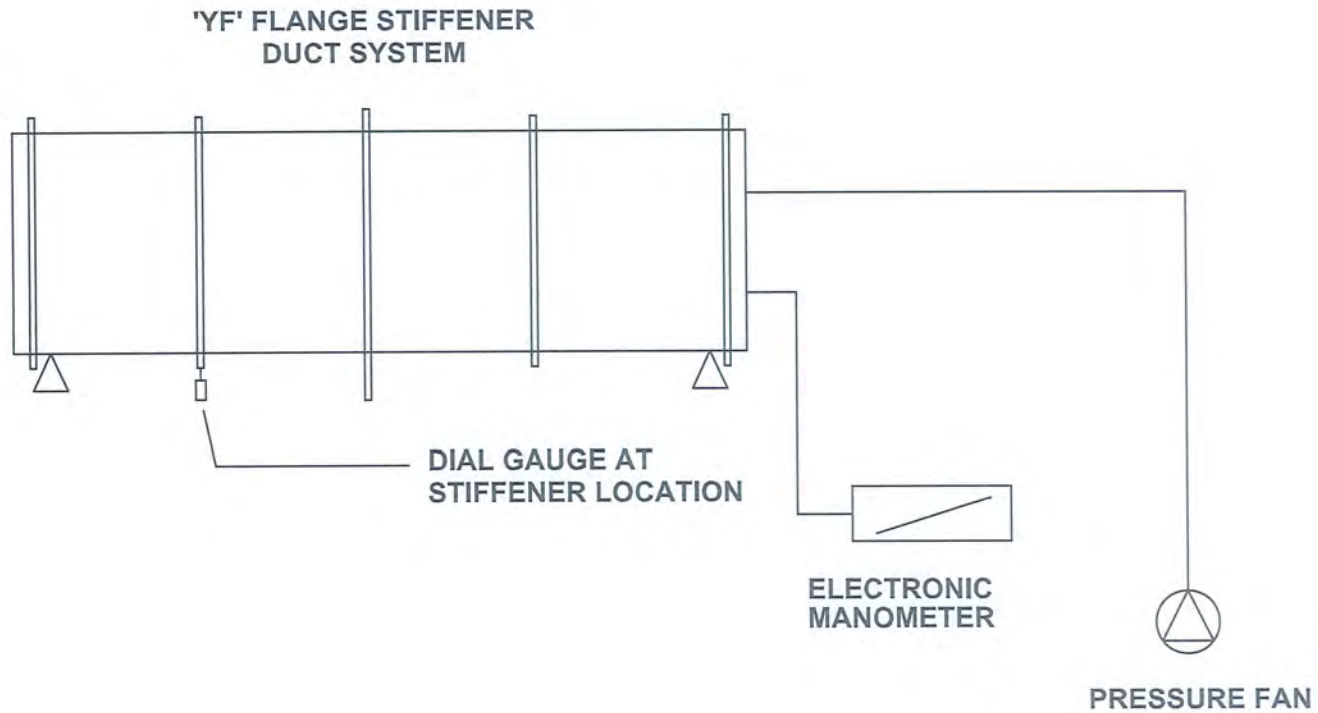
Scale: NTS

Date: 03/18

Dwg No: 180329R4\_A

 **Campbell Shillinglaw Lau Ltd.**

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**Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up**

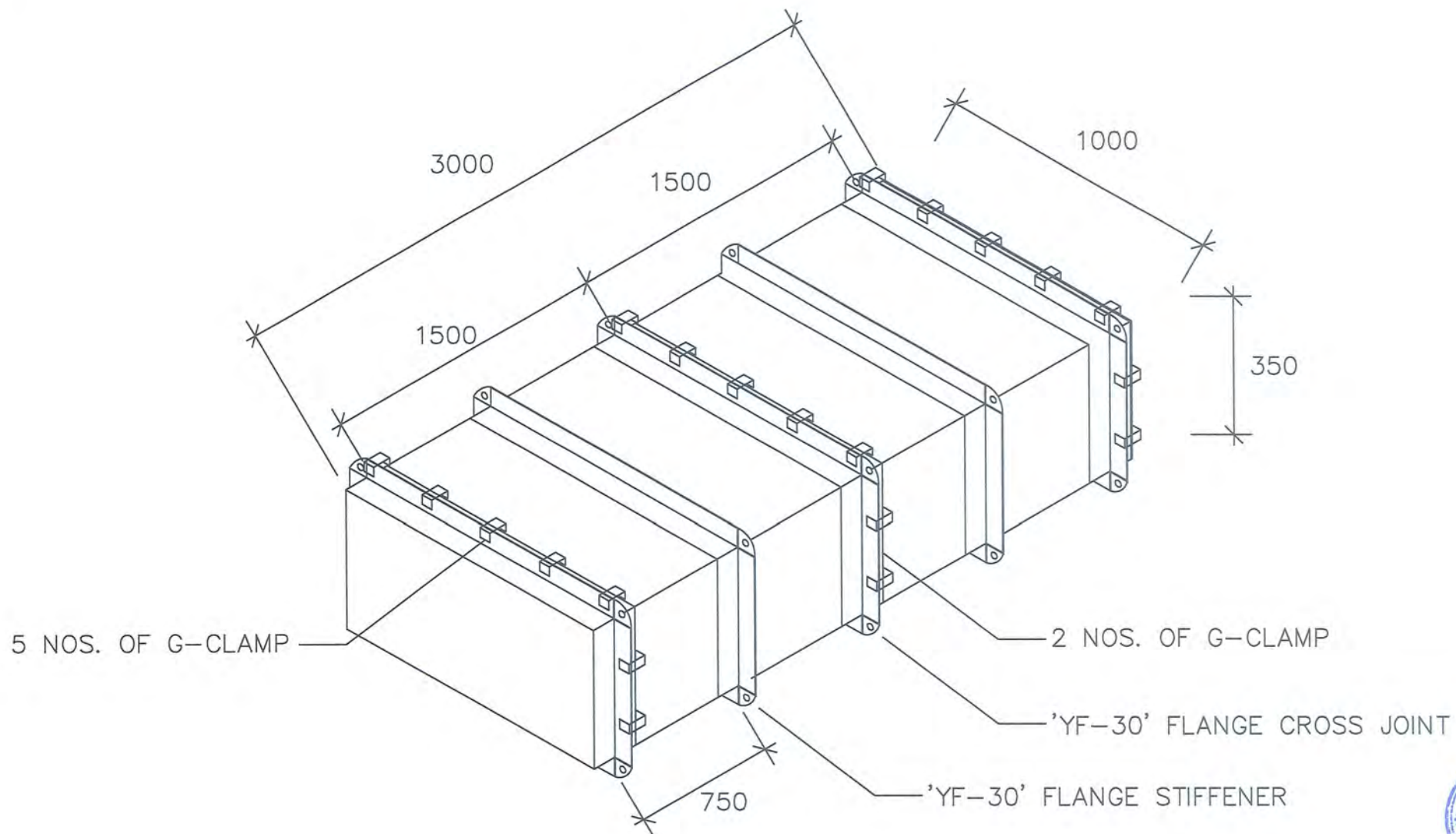
**Scale: NTS**

**Date: 03/18**

**Dwg No: 180329R4\_B**

** Campbell Shillinglaw Lau Ltd.**

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Title: Specimen of Size 3000mm(L) x 1000mm(W) x 350mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R4\_C

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

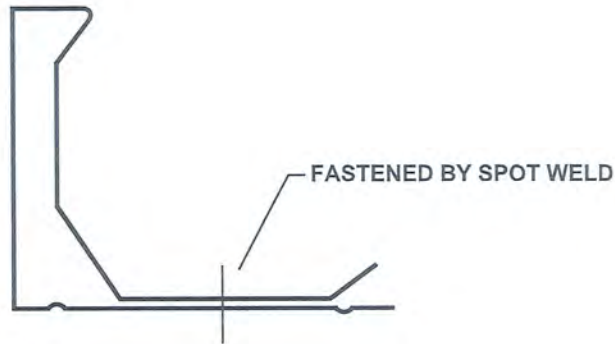
Scale: NTS

Date: 03/18

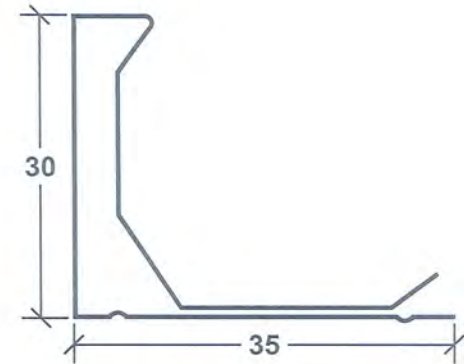
Dwg No: 180329R4\_D

 **Campbell Shillinglaw Lau Ltd.**

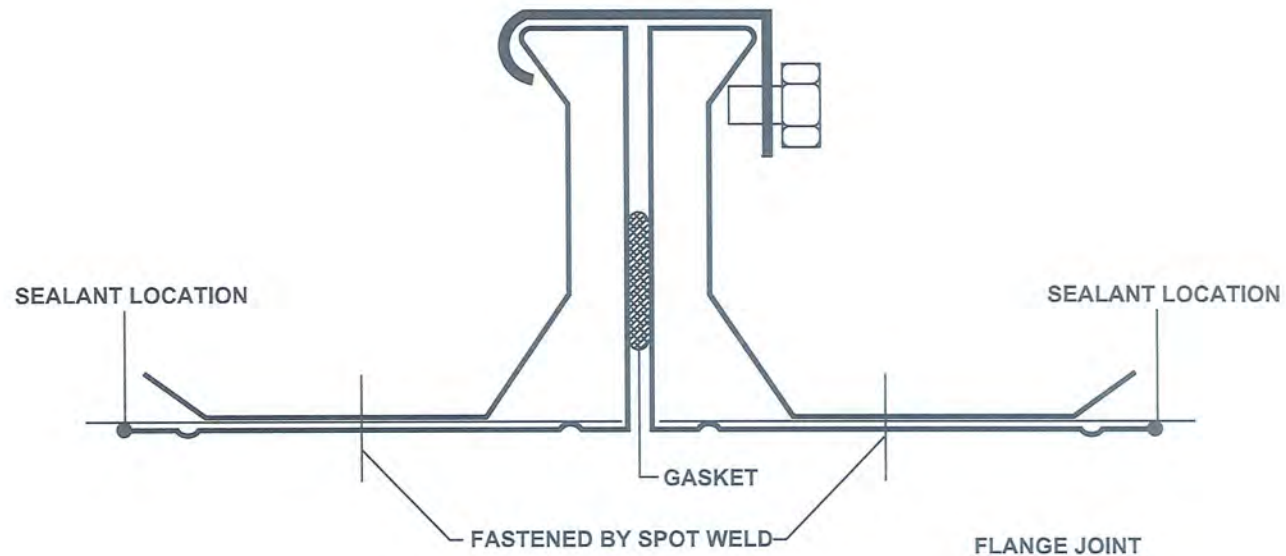
This drawing is the property of C S L L. No reproduction of any part by whatever means is permitted without prior written consent.



FLANGE STIFFENER



YF-30 FLANGE



Title: Detail of the Flange Joint (YF-30) & Flange Stiffener (YF-30)

Scale: NTS

Date: 03/18

Dwg No: 180329R4\_E

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**Campbell Shillinglaw Lau Ltd**  
金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE JOINT WITH STEEL ANGLE EXTERNAL STIFFENER FOR  
DUCT SYSTEM (CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R5



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on steel angle stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R5\_A and the detail set up for the deflection measurement is as shown in 180329R5\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R5\_C, were constructed:

Specimen: 1250 mm (W) x 450 mm (H) x 3000 mm (L)  
(Rated to J4 high pressure)

The test sample consists of a rectangular duct (1.0mm thick) which was prefabricated by pittsburg lock seam, 180329R5\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R5\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint by spot welding, and external stiffener by mechanical rivet at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp are as shown in 180329R5\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	5.77	6.48	7.18	7.42	7.15	6.53	5.84	1.36	5.0
Leakage rate L/s	0	0.20	0.25	0.35	0.24	0.19	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

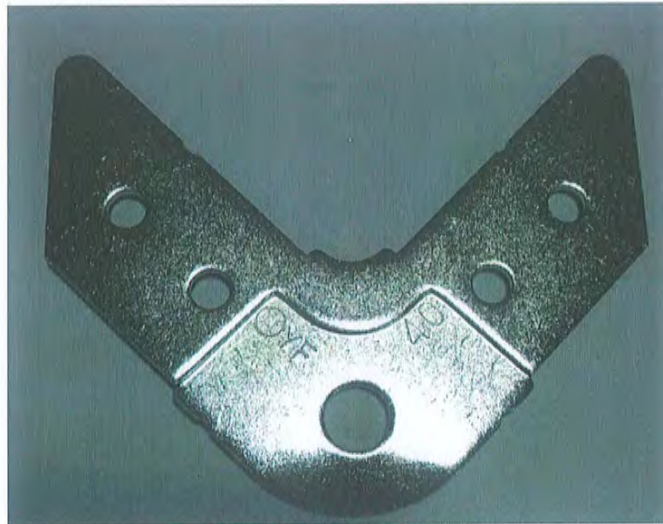
Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange (Rated to J4 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-40 Slide on Flange (Rated to J4 High Pressure)  
 Date of Test : 23<sup>th</sup> March, 2018

### Physical Detail:

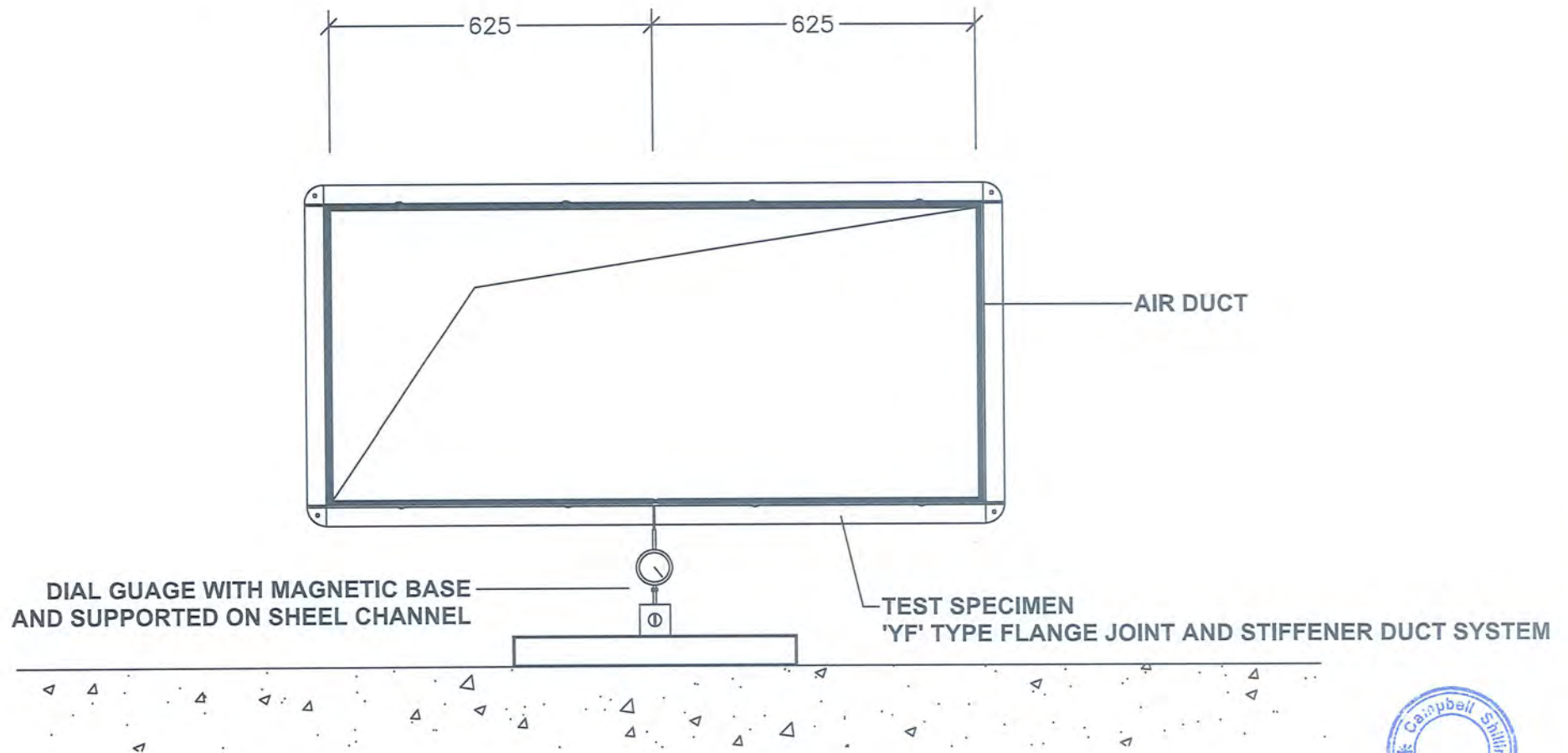
- |    |                                 |                                |
|----|---------------------------------|--------------------------------|
| 1. | Duct dimension                  | 1250(W) x 450(H) x 3000(L)     |
| 2. | Pressure classification         | C                              |
| 3. | Test static pressure            | 2000Pa                         |
| 4. | Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. | Surface area of duct under test | 10.2 sq. meter                 |
| 6. | Maximum permitted leakage * 40% | 1.71 litres / sec.             |

Please refer drawing for the configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
1250 x 450	3400	3000	10.2



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

Scale: NTS

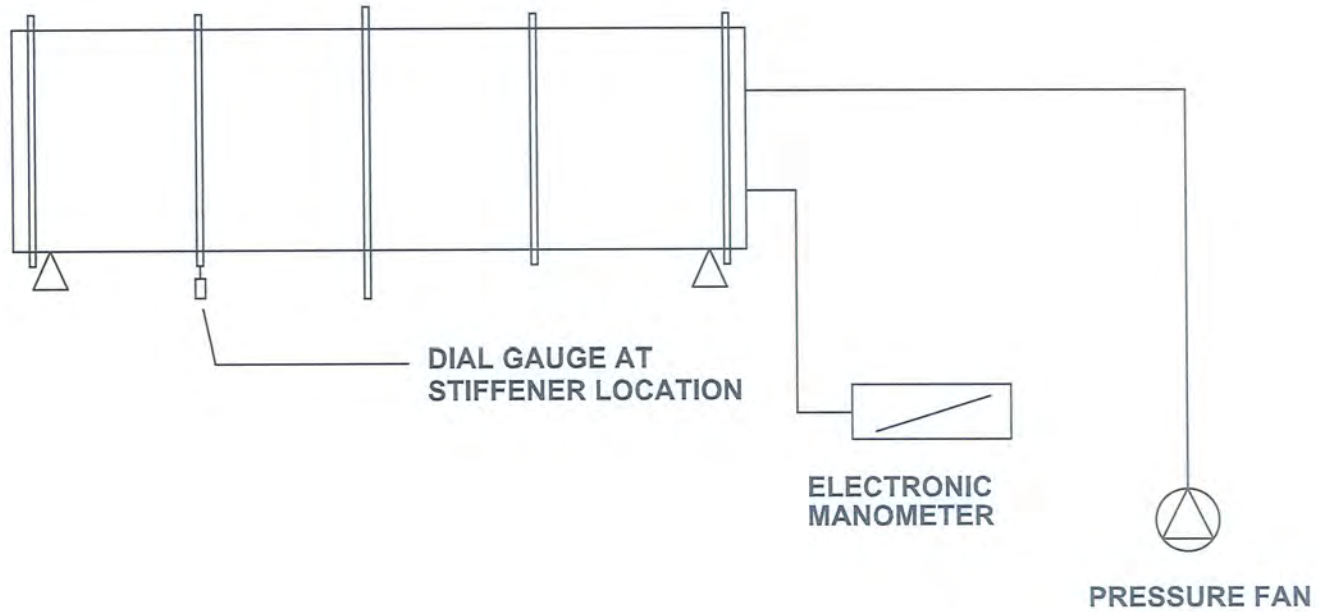
Date: 03/18

Dwg No: 180329R5\_A

 **Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up

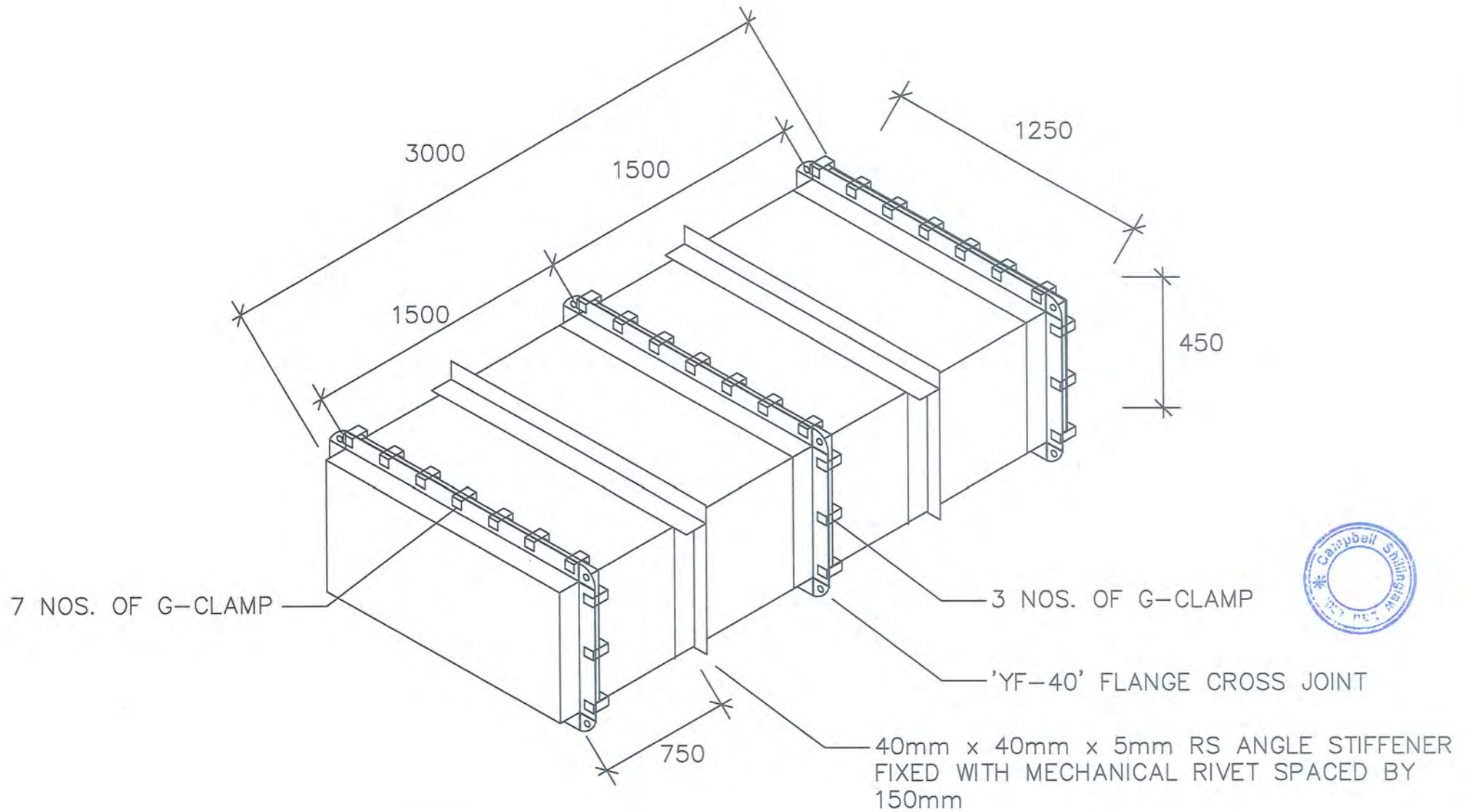
Scale: NTS

Date: 03/18

Dwg No: 180329R5\_B

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Title: Specimen of Size 3000mm(L) x 1250mm(W) x 450mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R5\_C

 **Campbell Shillinglaw Lau Ltd.**

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consent.





Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

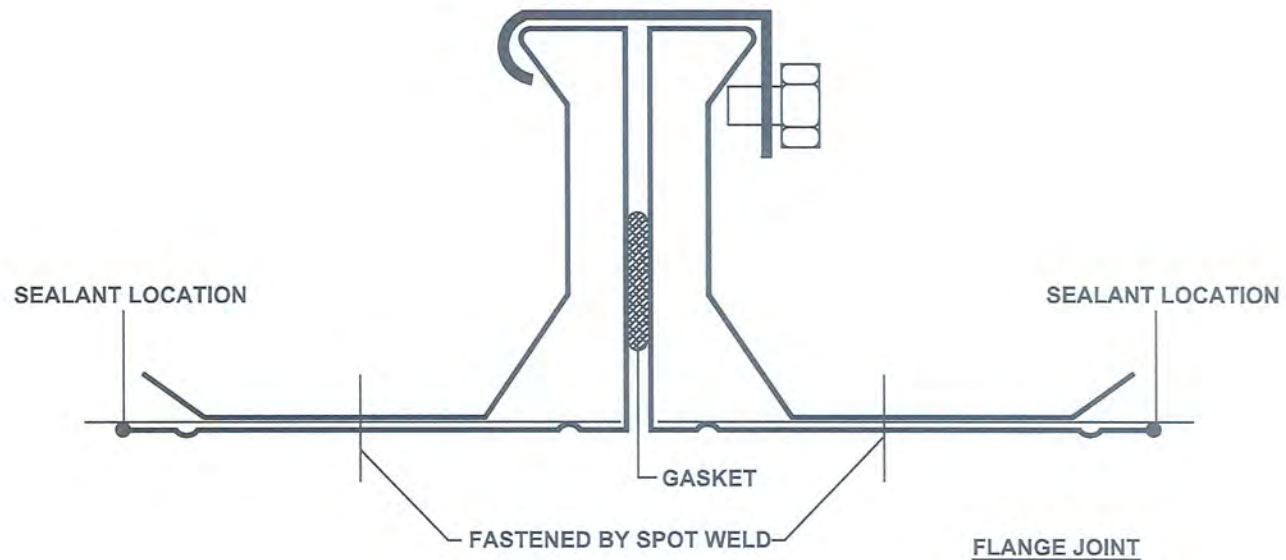
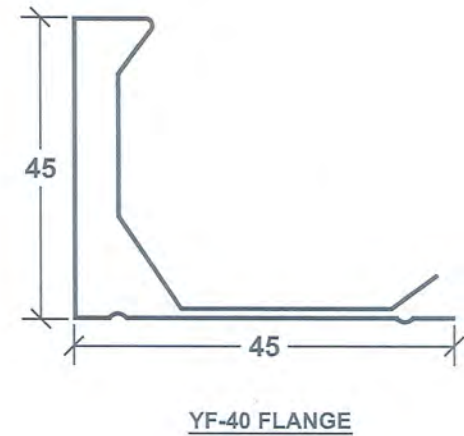
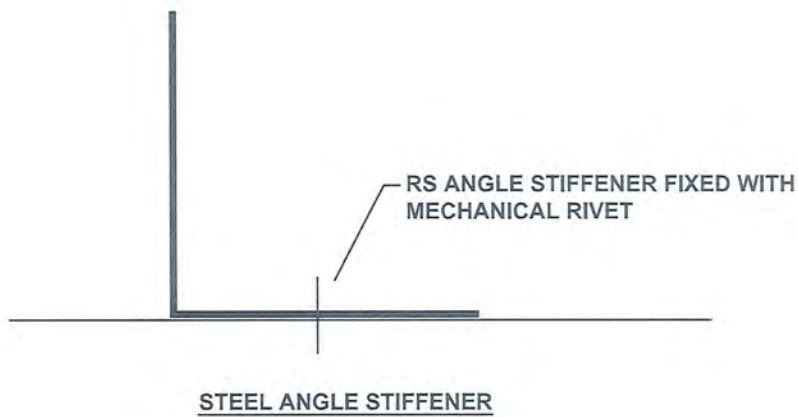
Scale: NTS

Date: 03/18

Dwg No: 180329R5\_D

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Title: Detail of the Flange Joint (YF-40) & Steel Angle Stiffener

Scale: NTS

Date: 03/18

Dwg No: 180329R5\_E

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**Campbell Shillinglaw Lau Ltd**  
金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE AS EXTERNAL STIFFENER FOR DUCT SYSTEM  
(CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018  
DATE OF TEST : 16<sup>TH</sup> MARCH, 2018  
REPORT BY : MR. LESLIE LAU (CSLL)  
TESTED BY : MR. HANG YUEN (CSLL)  
SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.  
TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG  
OUR REF. : CSLL009-2018/180329R6



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on flange stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R6\_A and the detail set up for the deflection measurement is as shown in 180329R6\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R6\_C, were constructed:

Specimen: 1250 mm (W) x 450 mm (H) x 3000 mm (L)  
(Rated to J4 high pressure)

The test sample consists of a rectangular duct (1.0mm thick) which was prefabricated by pittsburg lock seam, 180329R6\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R6\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint and external stiffener by spot welding at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp are as shown in 180329R6\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	32.32	33.56	35.18	35.78	35.22	33.66	32.23	2.93	5.0
Leakage rate L/s	0	0.16	0.28	0.36	0.27	0.16	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY



Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange (Rated to J4 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange (Rated to J4 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

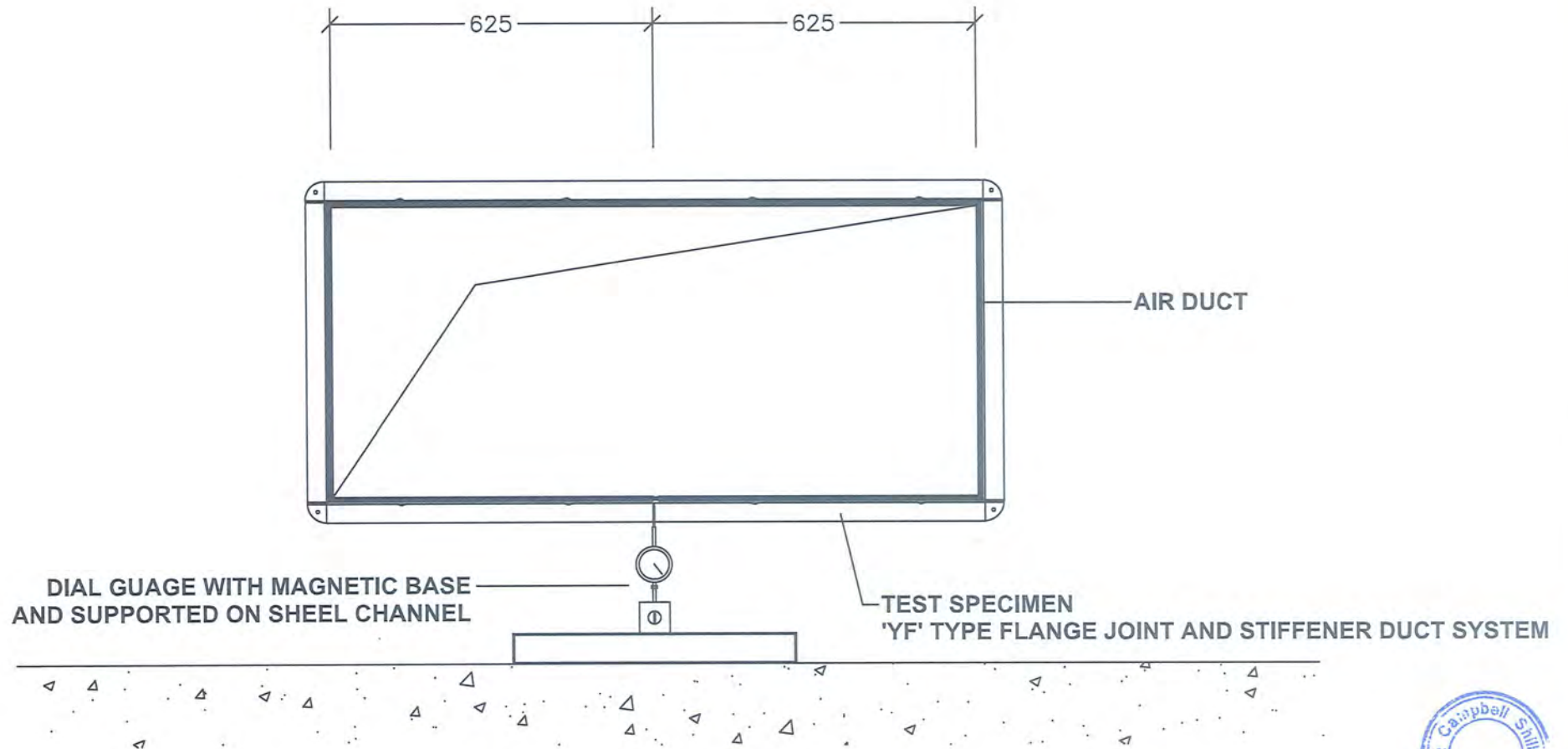
- |                                    |                                |
|------------------------------------|--------------------------------|
| 1. Duct dimension                  | 1250(W) x 450(H) x 3000(L)     |
| 2. Pressure classification         | C                              |
| 3. Test static pressure            | 2000Pa                         |
| 4. Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. Surface area of duct under test | 10.2 sq. meter                 |
| 6. Maximum permitted leakage * 40% | 1.71 litres / sec.             |

Please refer drawing for the configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
1250 x 450	3400	3000	10.2



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

Scale: NTS

Date: 03/18

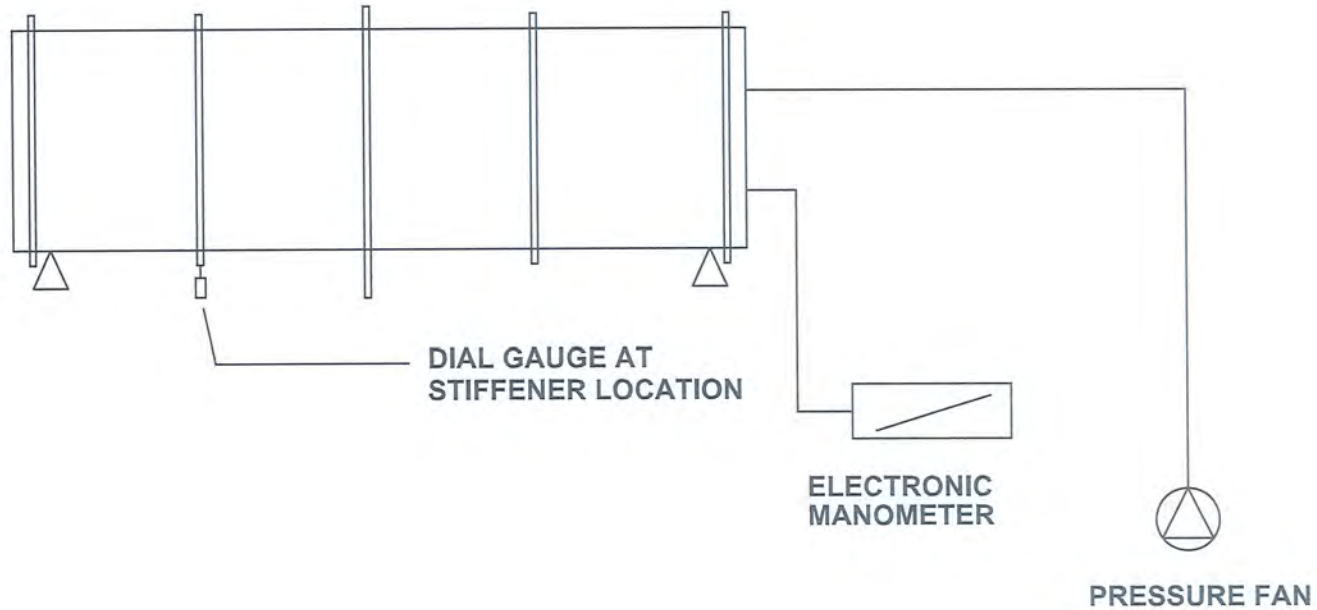
Dwg No: 180329R6\_A

 **Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Duct Stiffener Deflection Testing Set Up

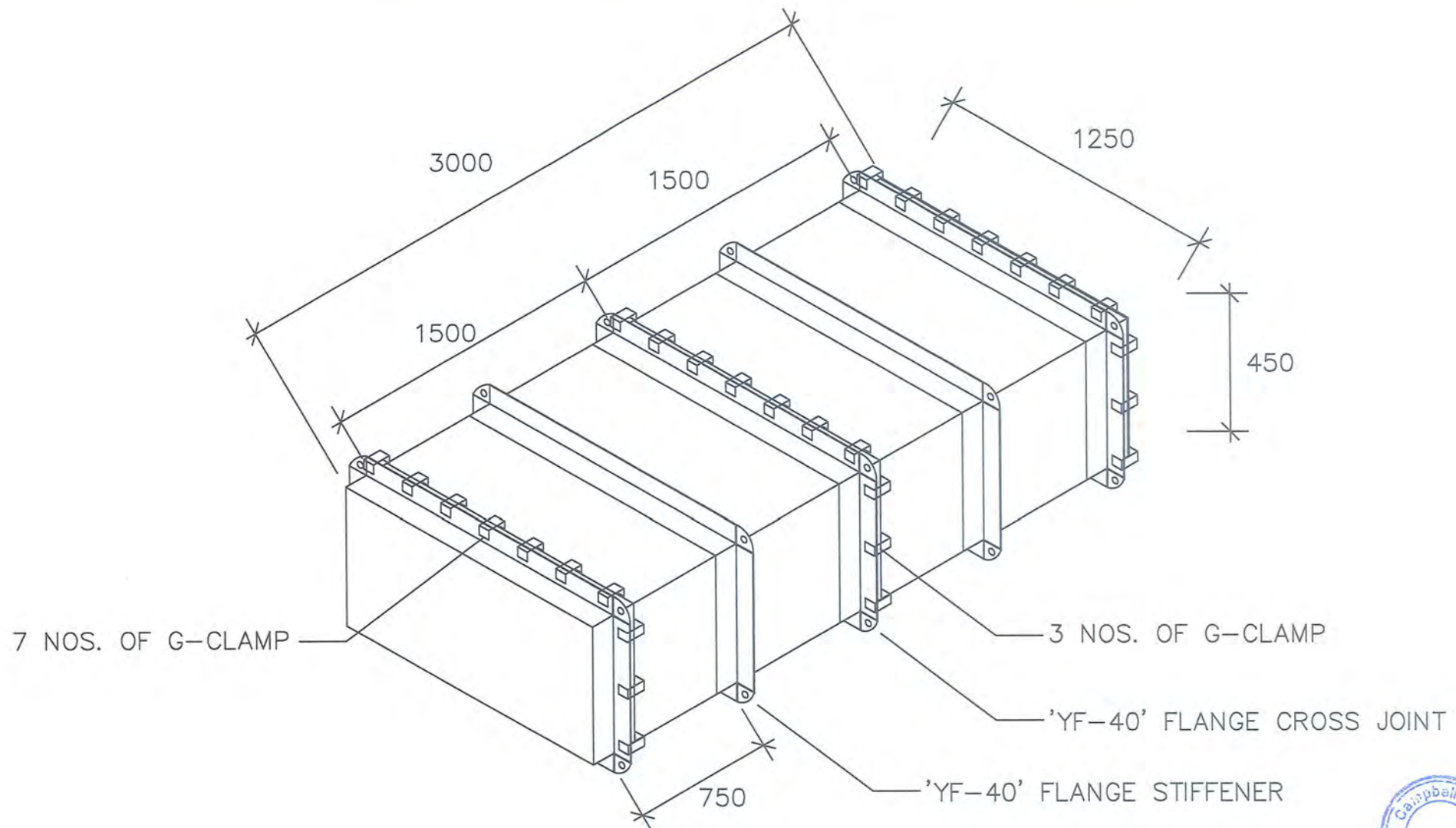
Scale: NTS

Date: 03/18

Dwg No: 180329R6\_B

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7 NOS. OF G-CLAMP

3 NOS. OF G-CLAMP

'YF-40' FLANGE CROSS JOINT

'YF-40' FLANGE STIFFENER



Title: Specimen of Size 3000mm(L) x 1250mm(W) x 450mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R6\_C

**Campbell Shillinglaw Lau Ltd.**

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

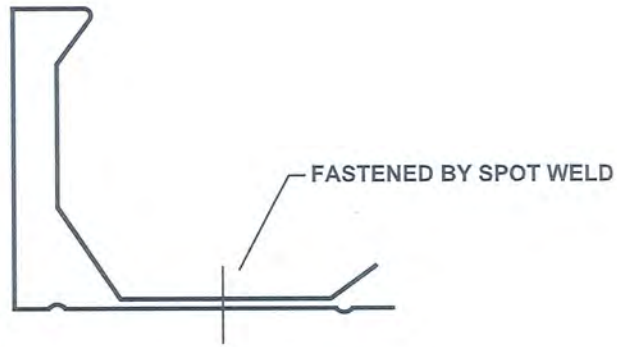
Scale: NTS

Date: 03/18

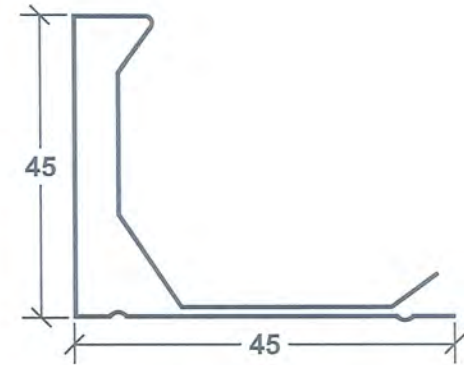
Dwg No: 180329R6\_D

 **Campbell Shillinglaw Lau Ltd.**

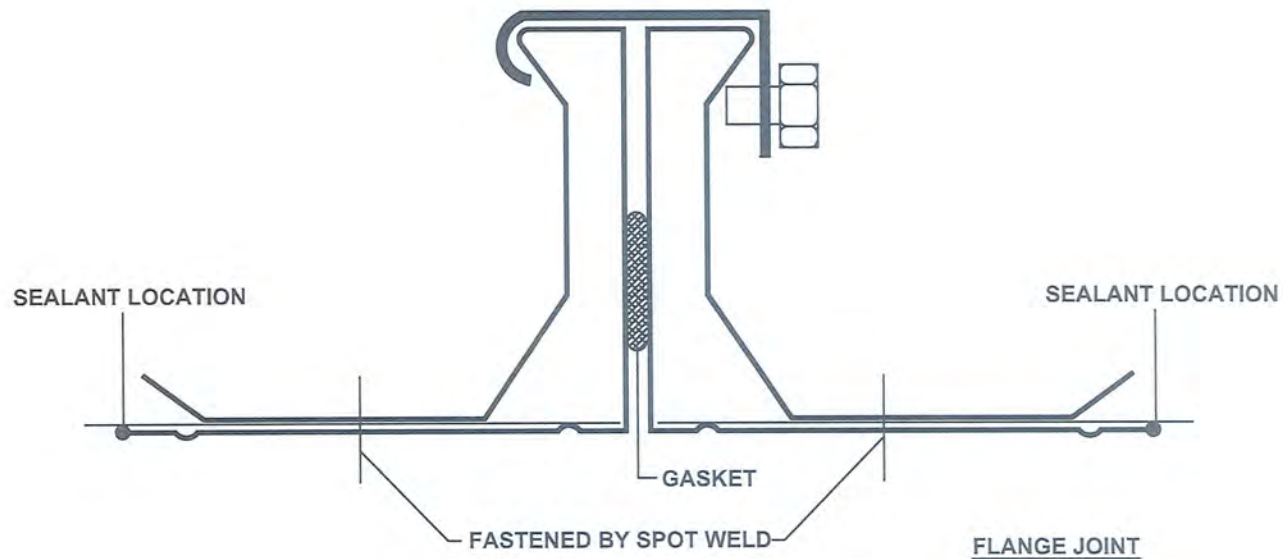
This drawing is the property of C S L L. No reproduction of any part by whatever means is permitted without prior written consent.



FLANGE STIFFENER



YF-40 FLANGE



Title: Detail of the Flange Joint (YF-40) & Flange Stiffener (YF-40)

Scale: NTS

Date: 03/18

Dwg No: 180329R6\_E

**Campbell Shillinglaw Lau Ltd.**

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REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE JOINT WITH STEEL ANGLE EXTERNAL STIFFENER FOR  
DUCT SYSTEM (CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R7



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on steel angle stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R7\_A and the detail set up for the deflection measurement is as shown in 180329R7\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R7\_C, were constructed:

Specimen: 2000 mm (W) x 700 mm (H) x 2500 mm (L) with tie rod  
(Rated to J5 high pressure)

The test sample consists of a rectangular duct (1.2mm thick) which was prefabricated by pittsburg lock seam, 180329R7\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R7\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint by spot welding, and external stiffener by mechanical rivet at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp are as shown in 180329R7\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	19.25	20.76	22.12	23.01	22.20	21.08	19.35	2.86	4
Leakage rate L/s	0	0.16	0.29	0.35	0.28	0.16	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange with Central Tie Rod  
(Rated to J5 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT





## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-40 Slide on Flange with Central Tie Rod  
 (Rated to J5 High Pressure)  
 Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

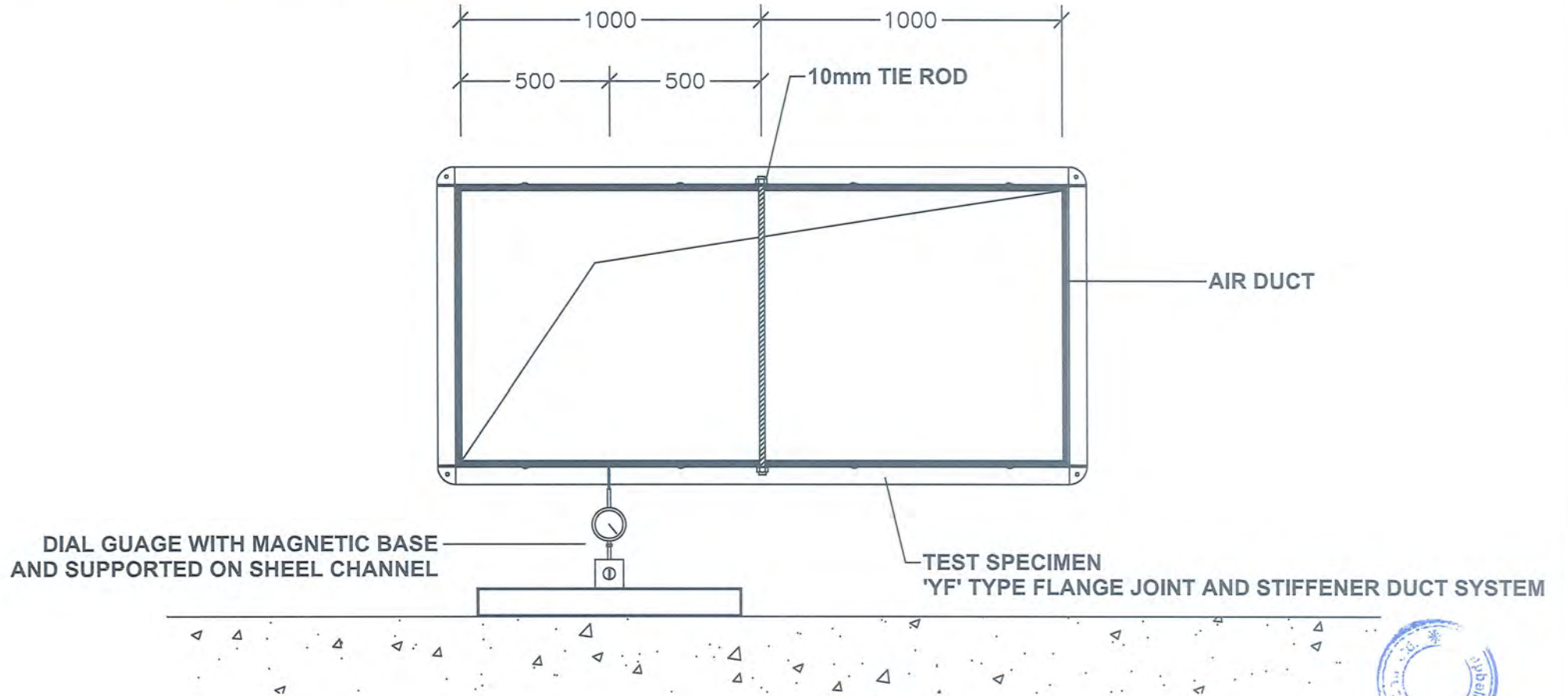
1. Duct dimension	2000(W) x 700(H) x 2500(L)
2. Pressure classification	C
3. Test static pressure	2000Pa
4. Leakage factor	0.42 litres / sec. / sq. meter
5. Surface area of duct under test	13.5 sq. meter
6. Maximum permitted leakage * 40%	2.27 litres / sec.

Please refer drawing for the configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp.

Width and Heigh (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
2000 x 700	5400	2500	13.5



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

Scale: NTS

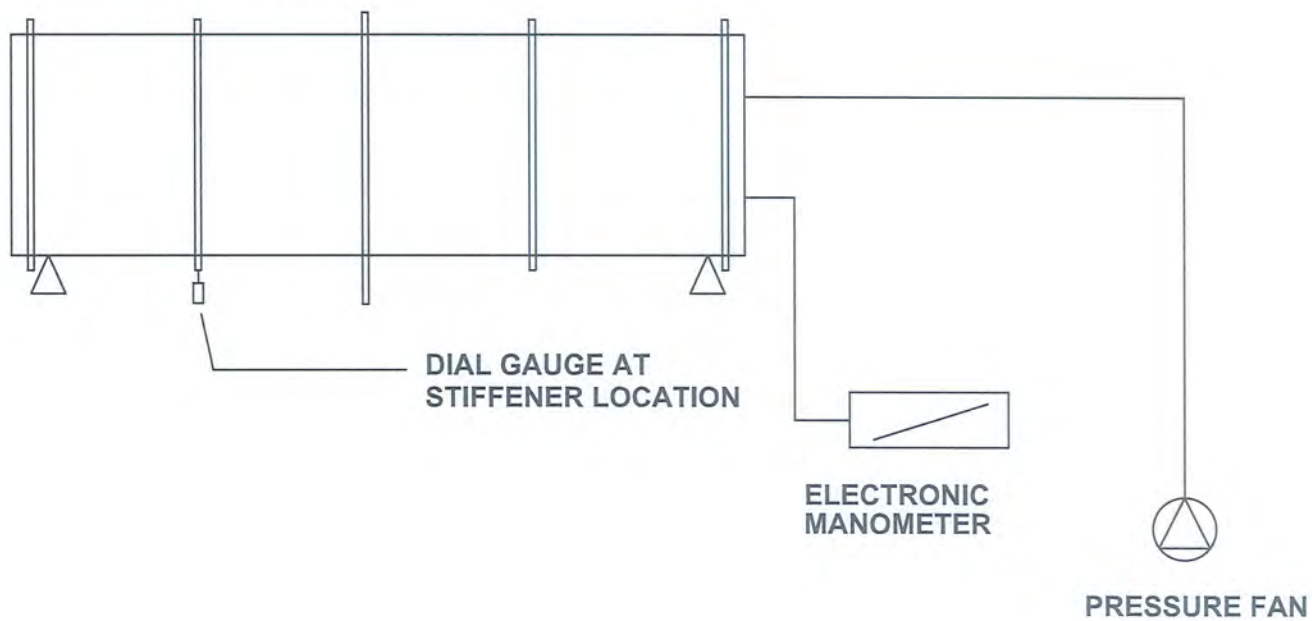
Date: 03/18

Dwg No: 180329R7\_A

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Stiffener Deflection Testing Set Up

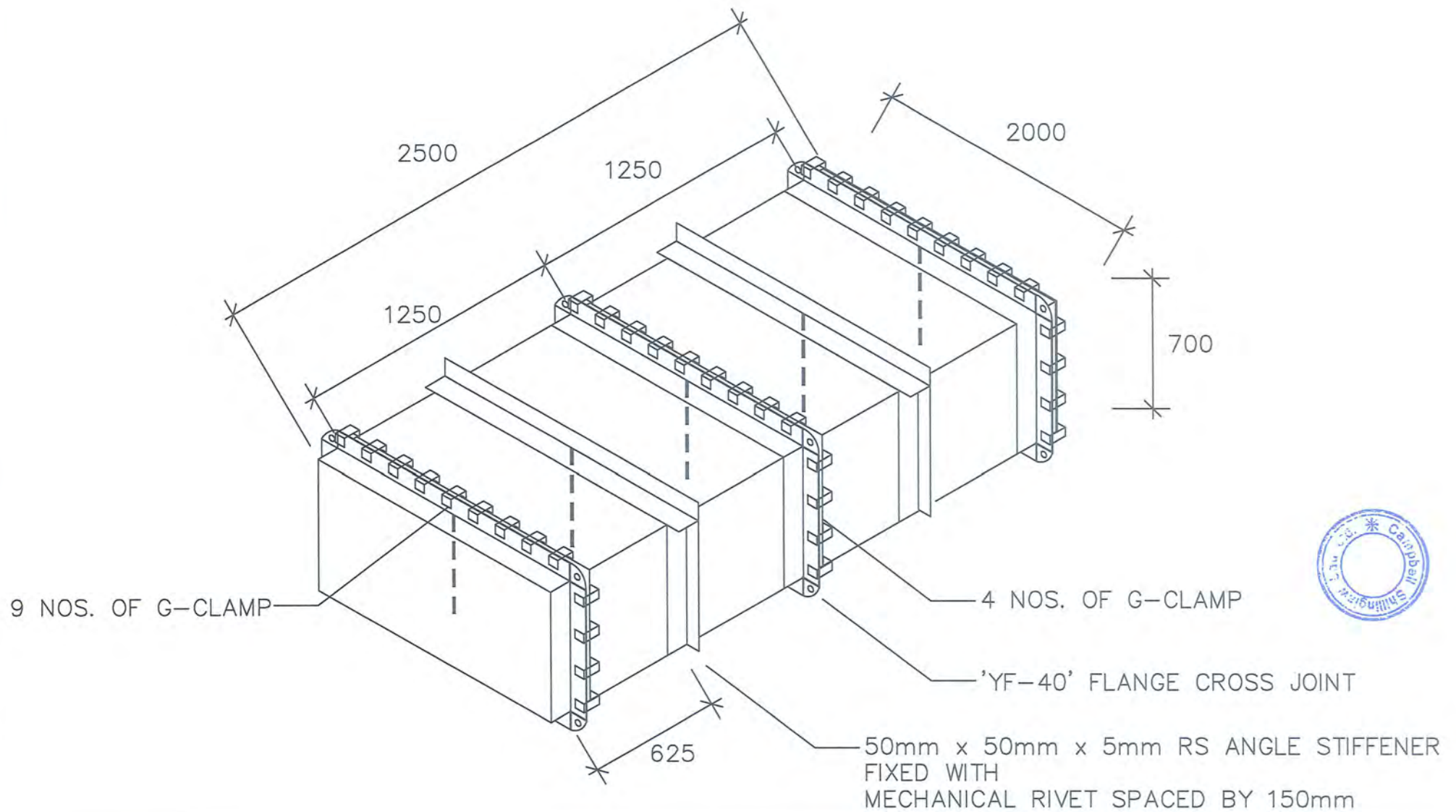
Scale: NTS

Date: 03/18

Dwg No: 180329R7\_B

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Title: Specimen of Size 2500mm(L) x 2000mm(W) x 700mm(H) - High Pressure

Scale: NTS

Date: 03/18

Dwg No: 180329R7\_C

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Pittsburg Lock Seam for Duct



Title: Pittsburg Lock Seam for Duct

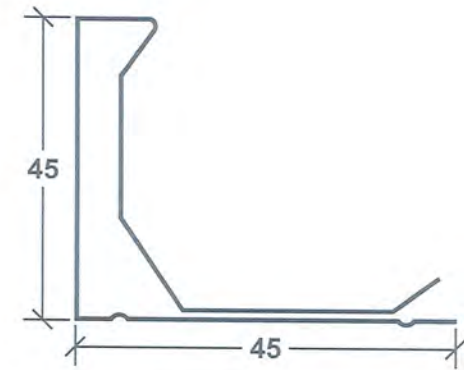
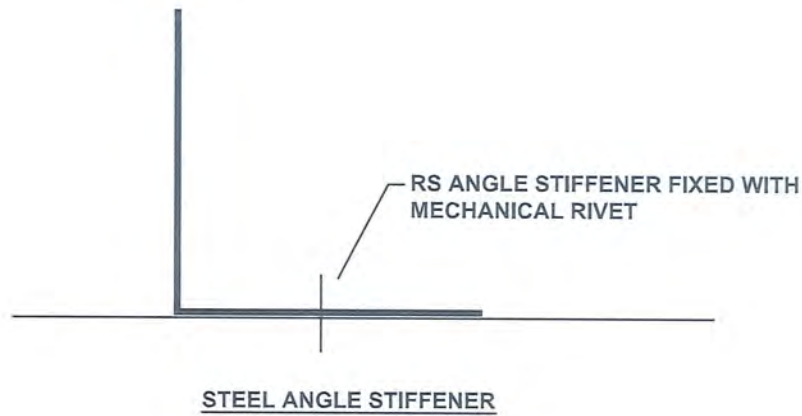
Scale: NTS

Date: 03/18

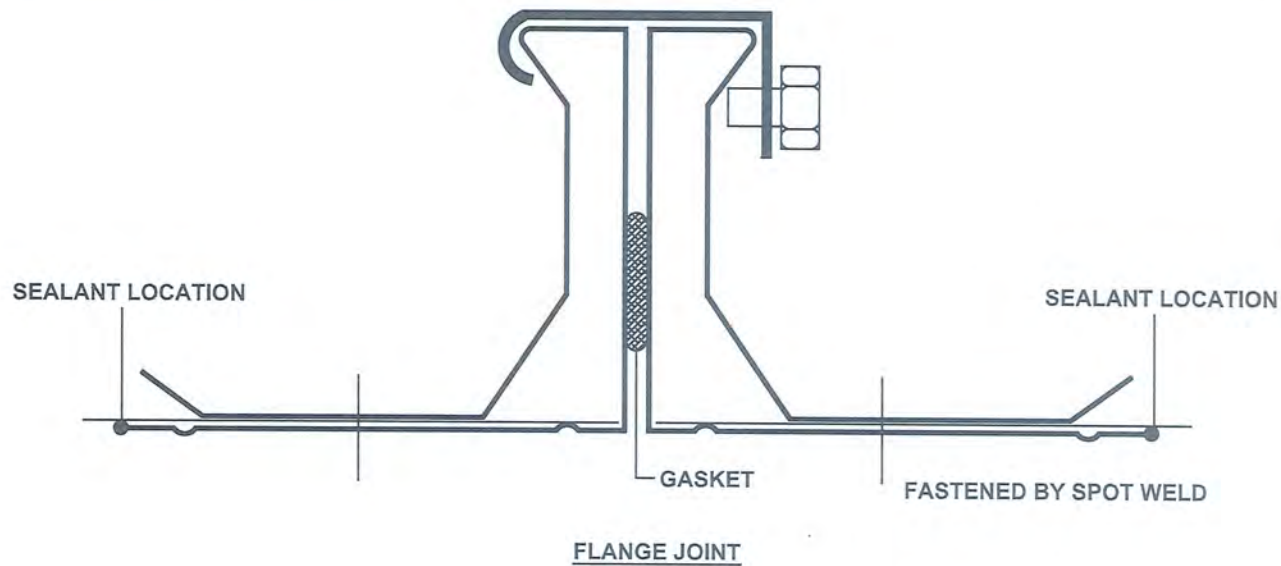
Dwg No: 180329R7\_D

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YF-40 FLANGE



Title: Detail of the Flange Joint (YF-40) & Steel Angle Stiffener

Scale: NTS

Date: 03/18

Dwg No: 180329R7\_E

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# Campbell Shillinglaw Lau Ltd

金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE AS EXTERNAL STIFFENER FOR DUCT SYSTEM  
(CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R8



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on flange stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R8\_A and the detail set up for the deflection measurement is as shown in 180329R8\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R8\_C, were constructed:

Specimen: 2000 mm (W) x 700 mm (H) x 2500 mm (L) with tie rod  
(Rated to J5 high pressure)

The test sample consists of a rectangular duct (1.2mm thick) which was prefabricated by pittsburg lock seam, 180329R8\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R8\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint and external stiffener by spot welding at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp are as shown in 180329R8\_E.





4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	22.30	23.42	24.05	24.43	23.96	23.66	22.02	1.85	4
Leakage rate L/s	0	0.17	0.28	0.38	0.27	0.17	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange with Central Tie Rod  
(Rated to J5 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-40 Slide on Flange with Central Tie Rod  
 (Rated to J5 High Pressure)  
 Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

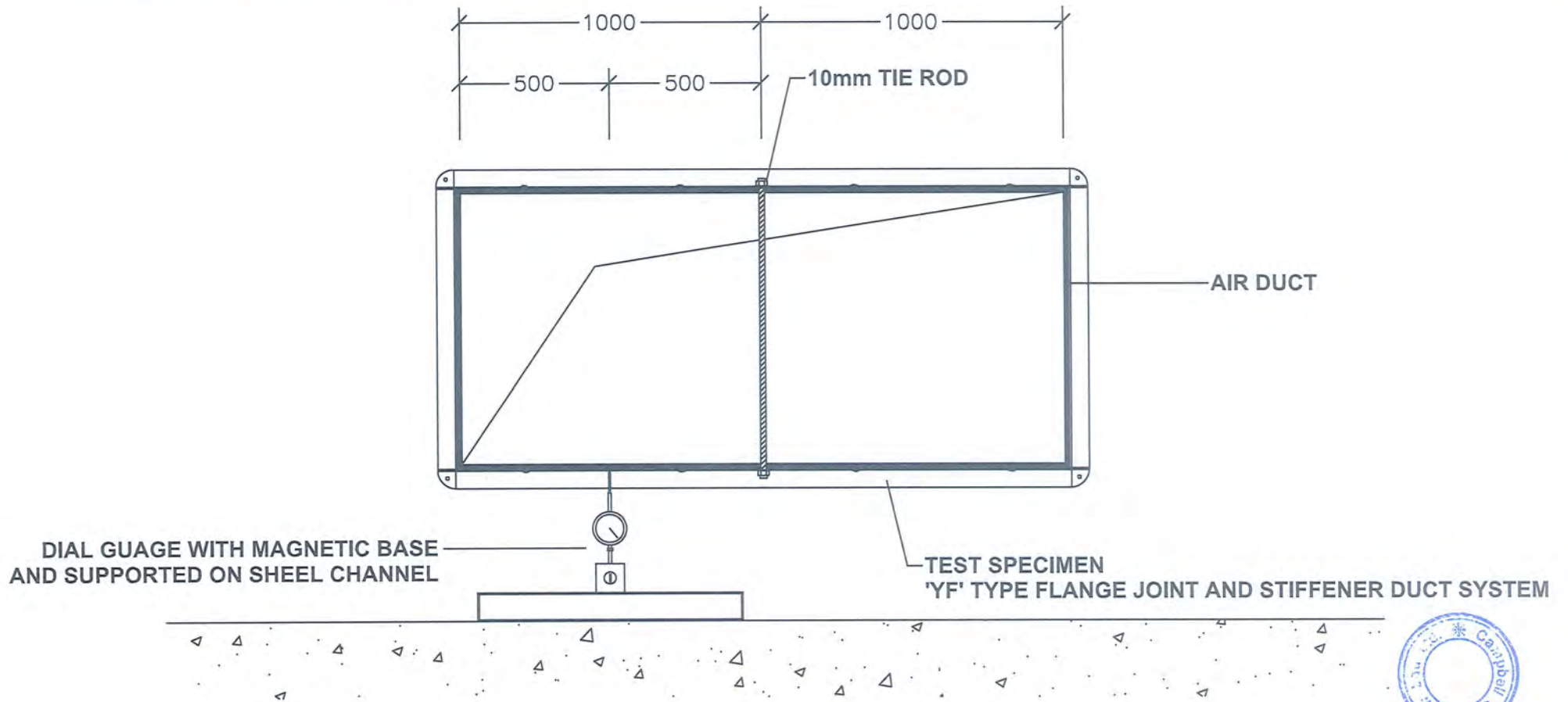
- |    |                                 |                                |
|----|---------------------------------|--------------------------------|
| 1. | Duct dimension                  | 2000(W) x 700(H) x 2500(L)     |
| 2. | Pressure classification         | C                              |
| 3. | Test static pressure            | 2000Pa                         |
| 4. | Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. | Surface area of duct under test | 13.5 sq. meter                 |
| 6. | Maximum permitted leakage * 40% | 2.27 litres / sec.             |

Please refer drawing for the configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
2000 x 700	5400	2500	13.5



DETAILED SETUP FOR DEFLECTION MEASUREMENT



Title: Detailed Setup for Deflection Measurement

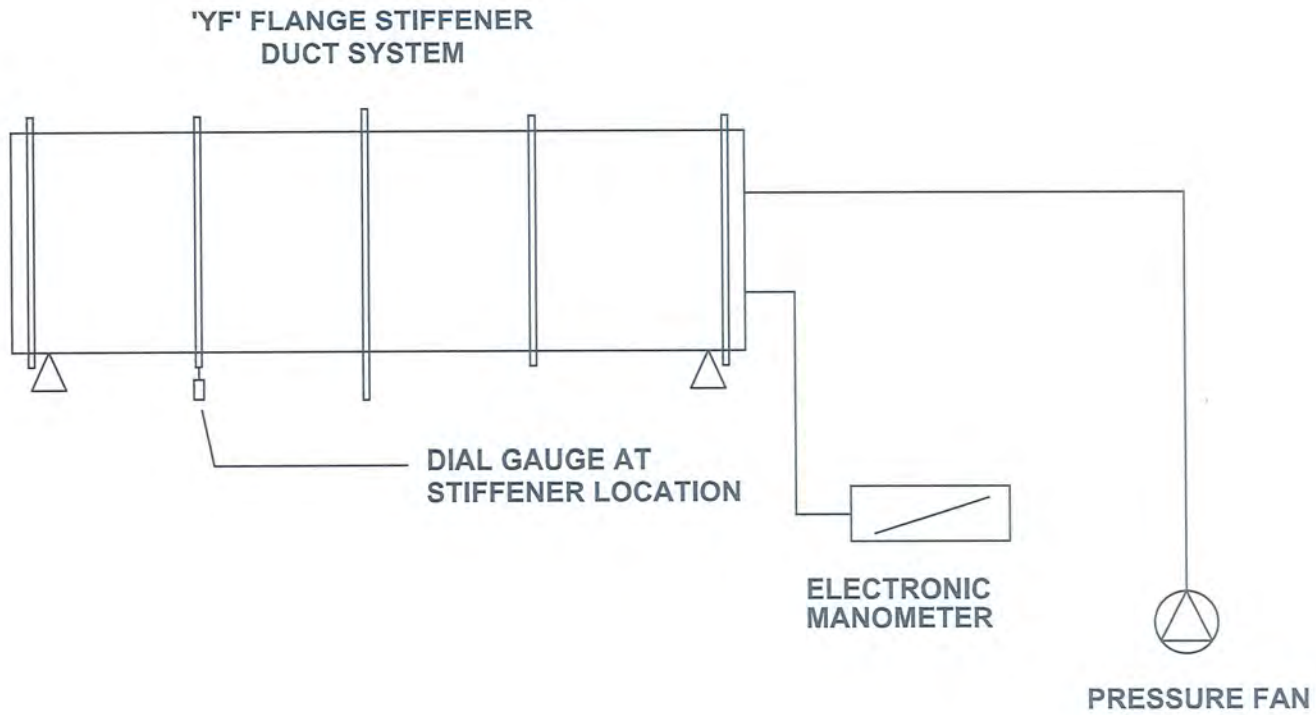
Scale: NTS

Date: 03/18

Dwg No: 180329R8\_A

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Title: Schematic Diagram of Stiffener Deflection Testing Set Up

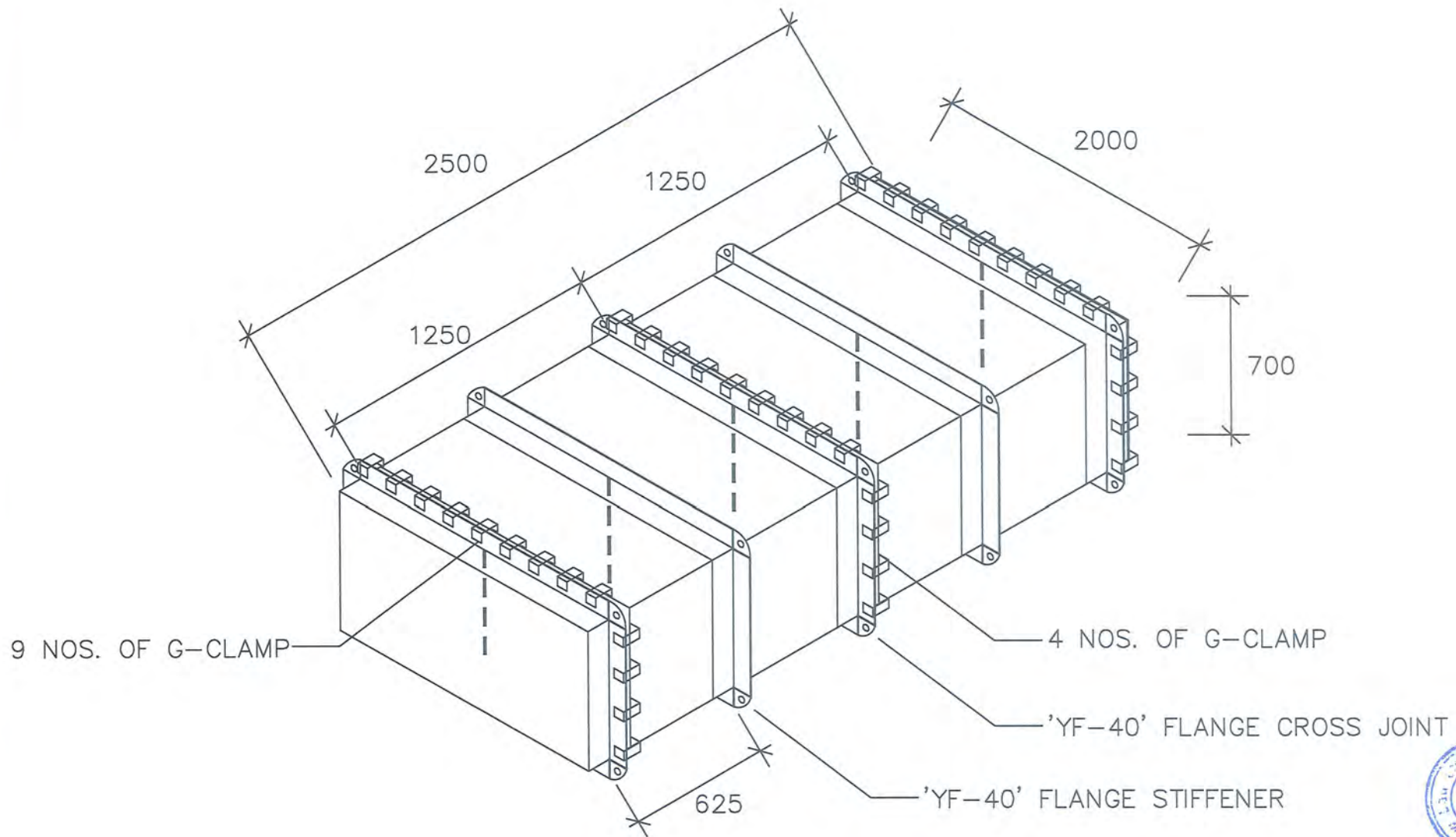
Scale: NTS

Date: 03/18

Dwg No: 180329R8\_B

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Title: Specimen of Size 2500mm(L) x 2000mm(W) x 700mm(H) - High Pressure

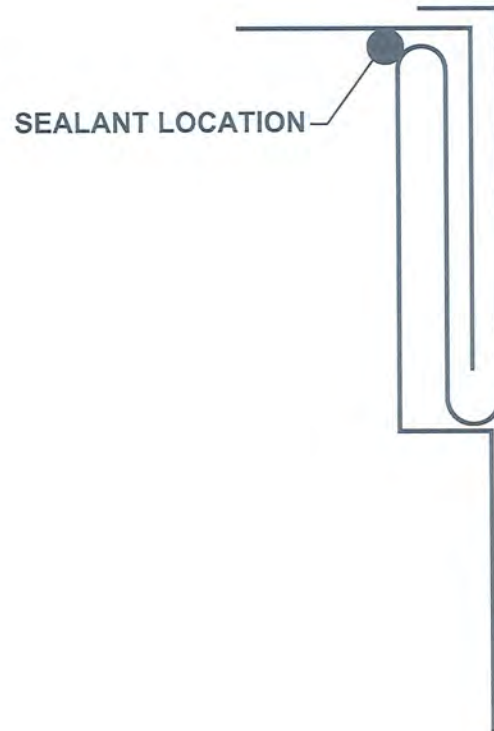
Scale: NTS

Date: 03/18

Dwg No: 180329R8\_C

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Pittsburg Lock Seam for Duct



Title: Pittsburg Lock Seam for Duct

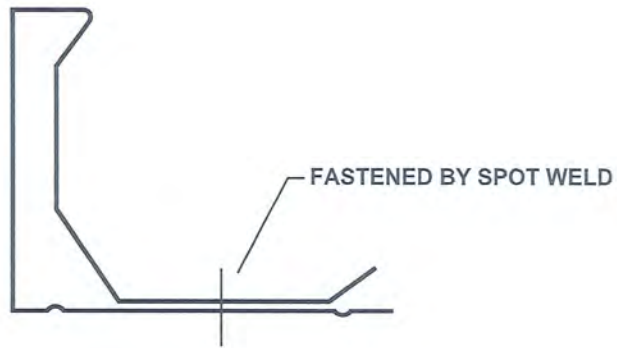
Scale: NTS

Date: 03/18

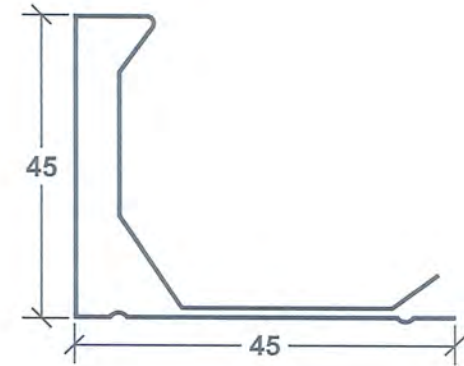
Dwg No: 180329R8\_D

 **Campbell Shillinglaw Lau Ltd.**

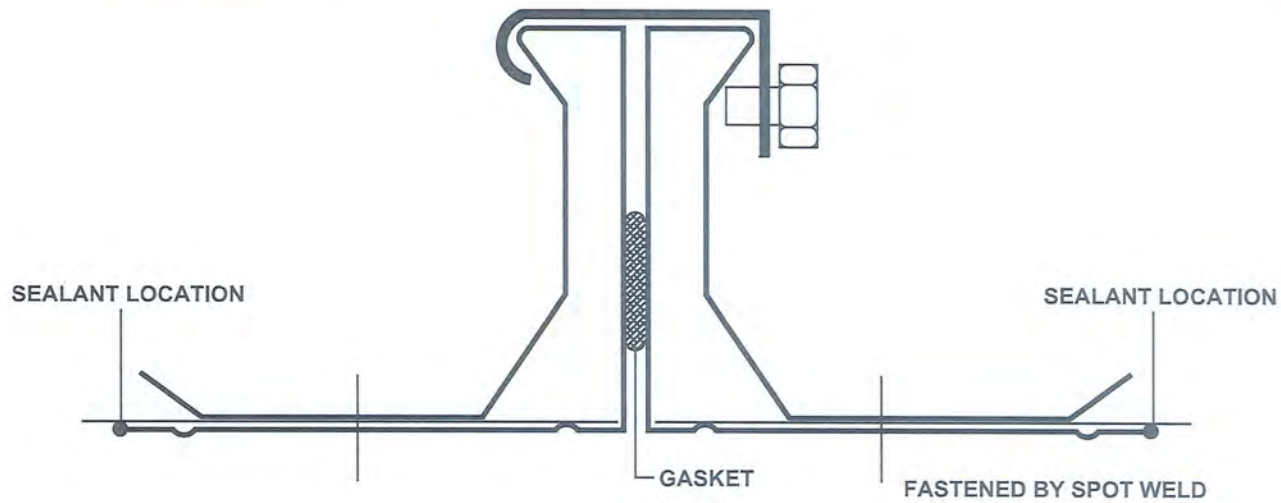
This drawing is the property of C S L L. No reproduction of any part by whatever means is permitted without prior written consent.



FLANGE STIFFENER



YF-40 FLANGE



FLANGE JOINT



Title: Detail of the Flange Joint (YF-40) & Flange Stiffener (YF-40)

Scale: NTS

Date: 03/18

Dwg No: 180329R8\_E

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# Campbell Shillinglaw Lau Ltd

## 金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE JOINT WITH STEEL ANGLE EXTERNAL STIFFENER FOR  
DUCT SYSTEM (CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018

DATE OF TEST : 16<sup>TH</sup> MARCH, 2018

REPORT BY : MR. LESLIE LAU (CSLL)

TESTED BY : MR. HANG YUEN (CSLL)

SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.

TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG

OUR REF. : CSLL009-2018/180329R9



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on steel angle stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R9\_A and the detail set up for the deflection measurement is as shown in 180329R9\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R9\_C, were constructed:

Specimen: 2500 mm (W) x 850 mm (H) x 2500 mm (L) with tie rod  
(Rated to J6 high pressure)

The test sample consists of a rectangular duct (1.2mm thick) which was prefabricated by pittsburg lock seam, 180329R9\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R9\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint by spot welding, and external stiffener by mechanical rivet at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp are as shown in 180329R9\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	14.42	15.41	16.88	17.32	16.92	15.50	14.47	2.46	2.5
Leakage rate L/s	0	0.31	0.38	0.48	0.39	0.31	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in "Section 4 Results", test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

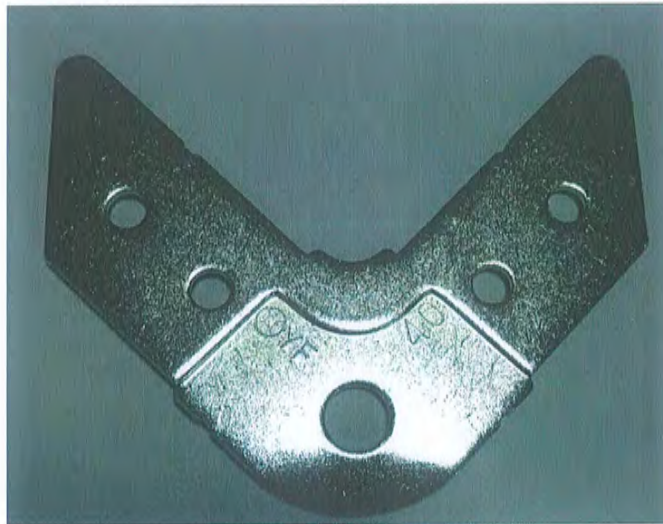
Leslie LAU  
For and on behalf of  
Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange with Central Tie Rod  
(Rated to J6 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange with Central Tie Rod  
(Rated to J6 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

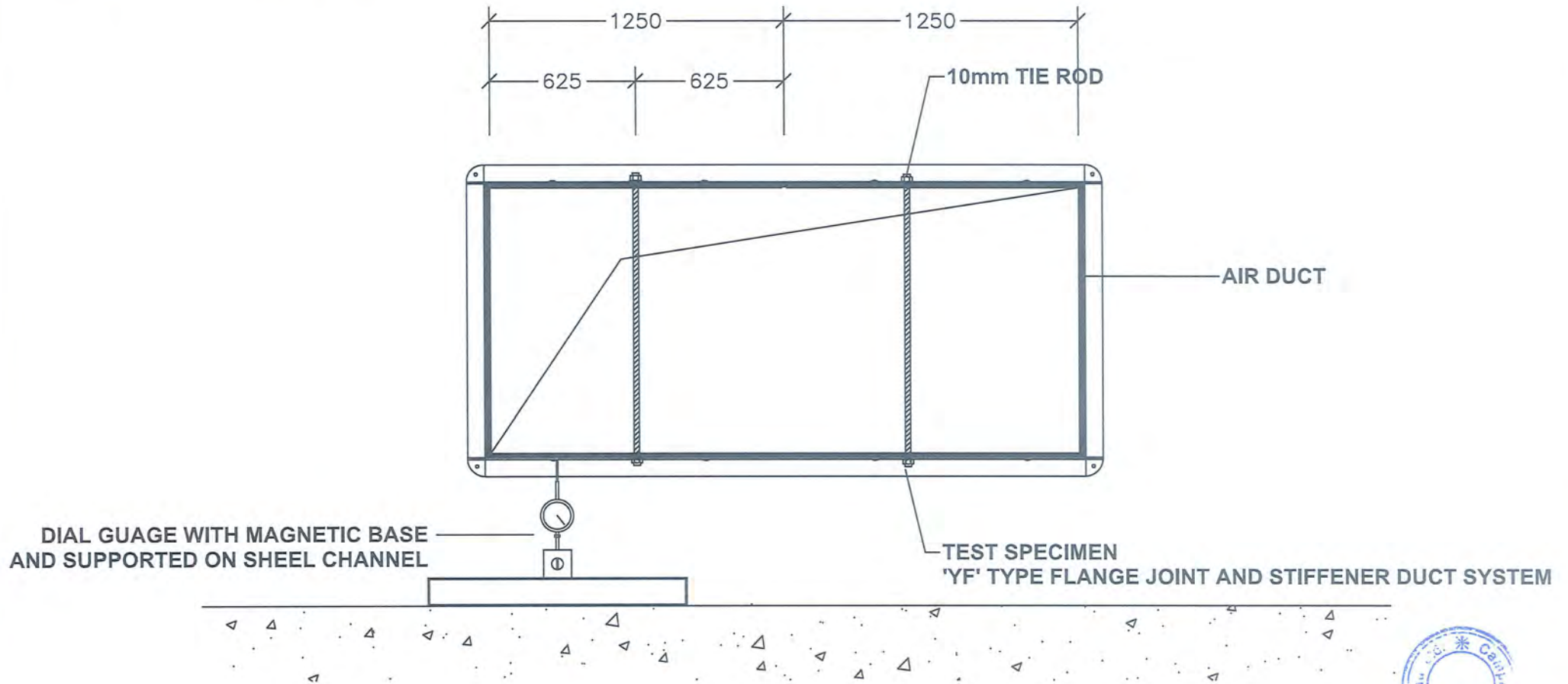
- |                                    |                                |
|------------------------------------|--------------------------------|
| 1. Duct dimension                  | 2500(W) x 850(H) x 2500(L)     |
| 2. Pressure classification         | C                              |
| 3. Test static pressure            | 2000Pa                         |
| 4. Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. Surface area of duct under test | 16.75 sq. meter                |
| 6. Maximum permitted leakage * 40% | 2.81 litres / sec.             |

Please refer drawing for the configuration of the flange joint, steel angle stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
2500 x 850	6700	2500	16.75



**DETAILED SETUP FOR DEFLECTION MEASUREMENT**



**Title: Detailed Setup for Deflection Measurement**

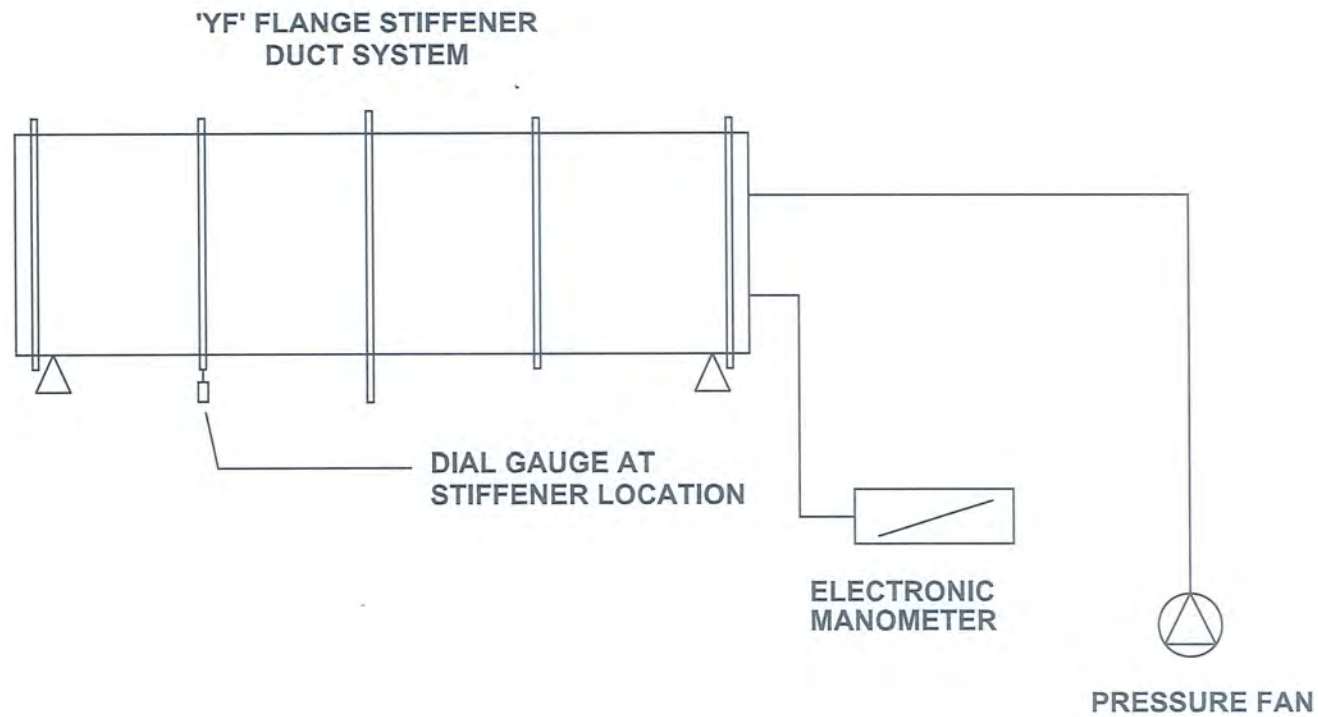
**Scale: NTS**

**Date: 03/18**

**Dwg No: 180329R9\_A**

** Campbell Shillinglaw Lau Ltd.**

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Title: Schematic Diagram of Stiffener Deflection Testing Set Up

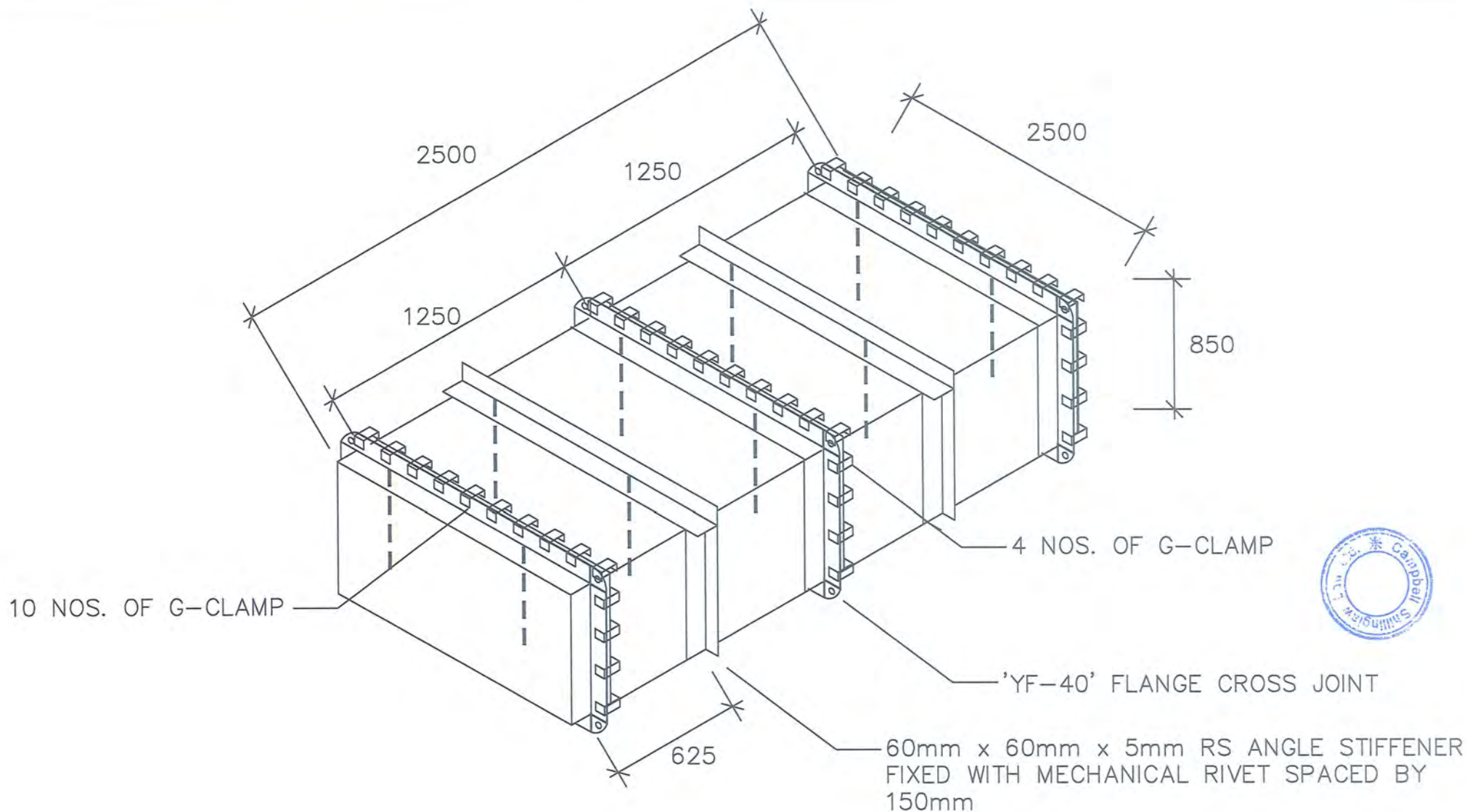
Scale: NTS

Date: 03/18

Dwg No: 180329R9\_B

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Title: Specimen of Size 2500mm(L) x 2500mm(W) x 850mm(H) - High Pressure

Scale: NTS

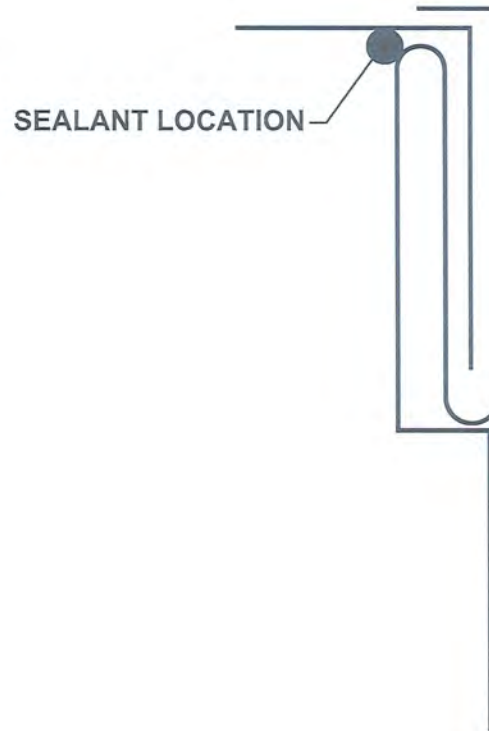
Date: 03/18

Dwg No: 180329R9\_C

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

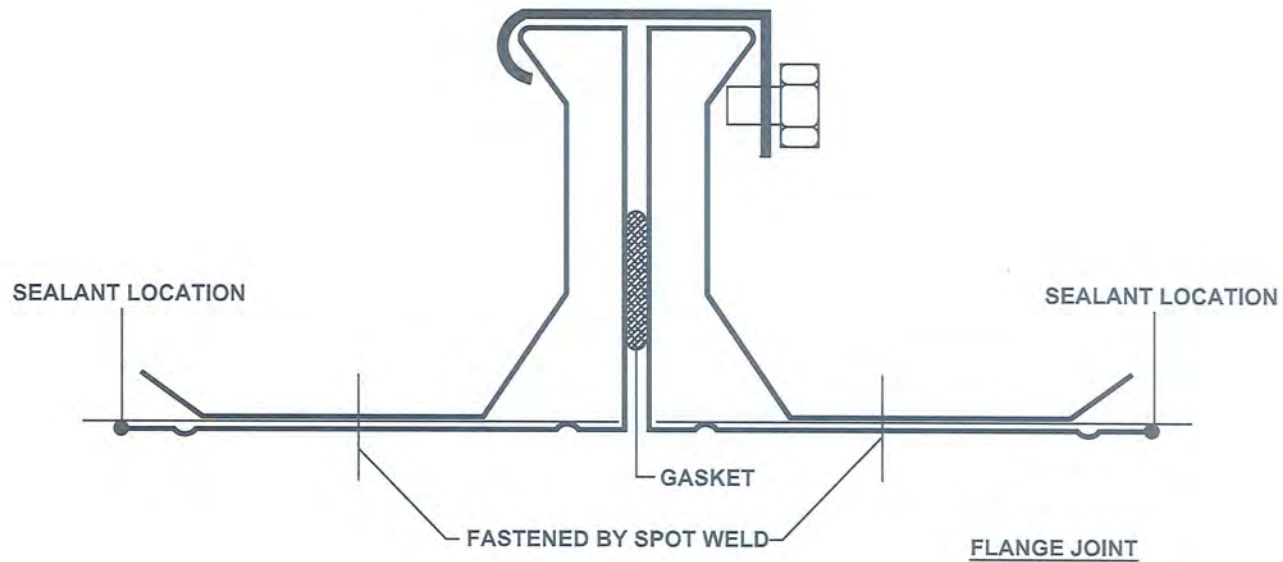
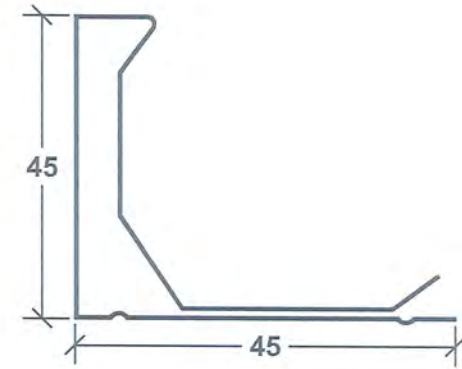
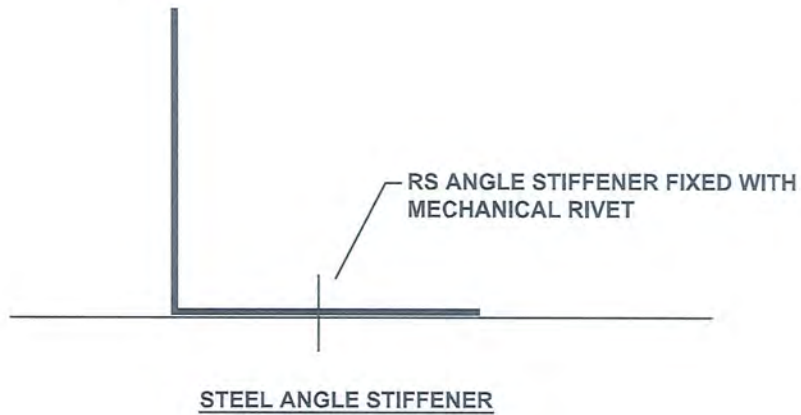
Scale: NTS

Date: 03/18

Dwg No: 180329R9\_D

 **Campbell Shillinglaw Lau Ltd.**

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Title: Detail of the Flange Joint (YF-40) & Steel Angle Stiffener

Scale: NTS

Date: 03/18

Dwg No: 180329R9\_E

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**Campbell Shillinglaw Lau Ltd**  
金寶聲學環保顧問有限公司

REPORT ON DEFLECTION OF DUCTWORK TEST

TO

DW144 (SPECIFICATION FOR SHEET METAL DUCTWORK 1998)  
FOR HIGH PRESSURE SYSTEM

ON

YF-40 SLIDE ON FLANGE AS EXTERNAL STIFFENER FOR DUCT SYSTEM  
(CLASSIFICATION TO DW/TM1)

REPORT DATE : 29<sup>TH</sup> MARCH, 2018  
DATE OF TEST : 16<sup>TH</sup> MARCH, 2018  
REPORT BY : MR. LESLIE LAU (CSLL)  
TESTED BY : MR. HANG YUEN (CSLL)  
SPONSOR OF TEST : YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD.  
TEST LOCATION : KAM SHUI S RD, KAM TIN, HONG KONG  
OUR REF. : CSLL009-2018/180329R10



## 1. INTRODUCTION

Campbell Shillinglaw Lau Limited were commissioned by YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. to carry out duct deflection behavior test on their YF-40 slide on flange stiffener for duct system in accordance with DW144 (Specification for Sheet Metal Ductwork, 1998) and DW/TM1.

## 2. TEST APPARATUS

a) The Test apparatus consists primarily of the followings:-

- Duct Leakage Tester with Manometer (TSI-Airflow Model Pan 300 Series), the tester consists of a variable speed fan motor with a motor speed controller to adjust the ductwork pressure and a manometer (TA465-P) which measures the static pressure of the duct and also the corresponding inlet flow rate to sustain the duct leakage.
- A flexible hose connecting the Leakage Tester and the sheet metal duct specimen.
- A dial gauge giving readings of 0.01mm resolution and a maximum traverse of 50mm.

The overall experimental set up is as shown in 180329R10\_A and the detail set up for the deflection measurement is as shown in 180329R10\_B.

## 3. TEST SAMPLE

The test specimen of the following dimension, 180329R10\_C, were constructed:

Specimen: 2500 mm (W) x 850 mm (H) x 2440 mm (L) with tie rod  
(Rated to J6 high pressure)

The test sample consists of a rectangular duct (1.2mm thick) which was prefabricated by pittsburg lock seam, 180329R10\_D, and ready for duct section assembly.

The YF-40 flange was made by a YUEN FONG AIR-CONDITION PRODUCTS (HK) LTD. factory machine (180329R10\_E). The corner piece used to connect the flange is shown in Appendix A.

The YF-40 slide on flange was fastened to the duct section to form a cross joint and external stiffener by spot welding at 50mm from corners and 150mm o.c. for the rest. Configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp are as shown in 180329R10\_E.



4. RESULTS

Test Static Pressure	Pressure, Pa							Calculated Deflection 0 to 2000Pa (mm)	Allowable Deflection Width
	0	1000	2000	Over 2000	2000	1000	0		
Dial Gauge Reading	8.05	9.71	10.40	11.11	10.32	9.92	7.71	2.48	2.5
Leakage rate L/s	0	0.36	0.41	0.49	0.43	0.38	0		

N.B. The allowable deflection is in accordance to DW/TM1 and equal to 1/250 of width or where tie rods are used, 1/250 of span between central tie rod and the side of the duct.

5. CONCLUSION

As shown in “Section 4 Results”, test specimen did not exceed the deflection requirement of DW/TM1 as stipulated.

TEST AND REPORT BY

*Leslie Lau*

Leslie LAU  
 For and on behalf of  
 Campbell Shillinglaw Lau Ltd.



## Appendix A

Project : Duct Deflection Behavior Test  
Title : YF-40 Slide on Flange with Central Tie Rod  
(Rated to J6 High Pressure)  
Date of Test : 16<sup>th</sup> March, 2018

Photos:



'YF-40' CORNER PIECE



'YF-40' FLANGE CROSS JOINT



## Appendix B

Project : Duct Deflection Behavior Test  
 Title : YF-40 Slide on Flange with Central Tie Rod  
 (Rated to J6 High Pressure)  
 Date of Test : 16<sup>th</sup> March, 2018

### Physical Detail:

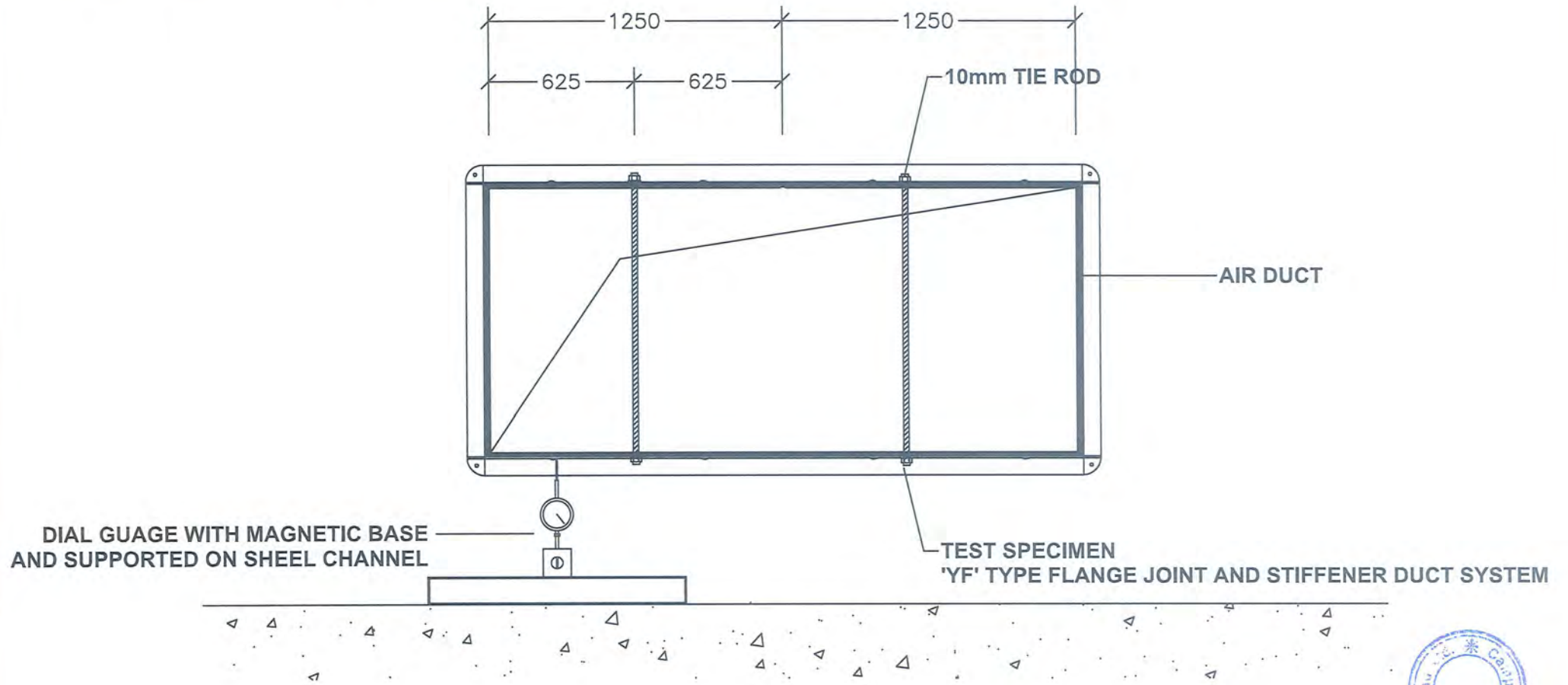
- |    |                                 |                                |
|----|---------------------------------|--------------------------------|
| 1. | Duct dimension                  | 2500(W) x 850(H) x 2500(L)     |
| 2. | Pressure classification         | C                              |
| 3. | Test static pressure            | 2000Pa                         |
| 4. | Leakage factor                  | 0.42 litres / sec. / sq. meter |
| 5. | Surface area of duct under test | 16.75 sq. meter                |
| 6. | Maximum permitted leakage * 40% | 2.81 litres / sec.             |

Please refer drawing for the configuration of the flange joint, flange stiffener, the sheet metal duct and the G-clamp.

Width and Height (mm)	Periphery (mm)	Length (mm)	Area (m <sup>2</sup> )
2500 x 850	6700	2500	16.75



**DETAILED SETUP FOR DEFLECTION MEASUREMENT**



**Title: Detailed Setup for Deflection Measurement**

**Scale: NTS**

**Date: 03/18**

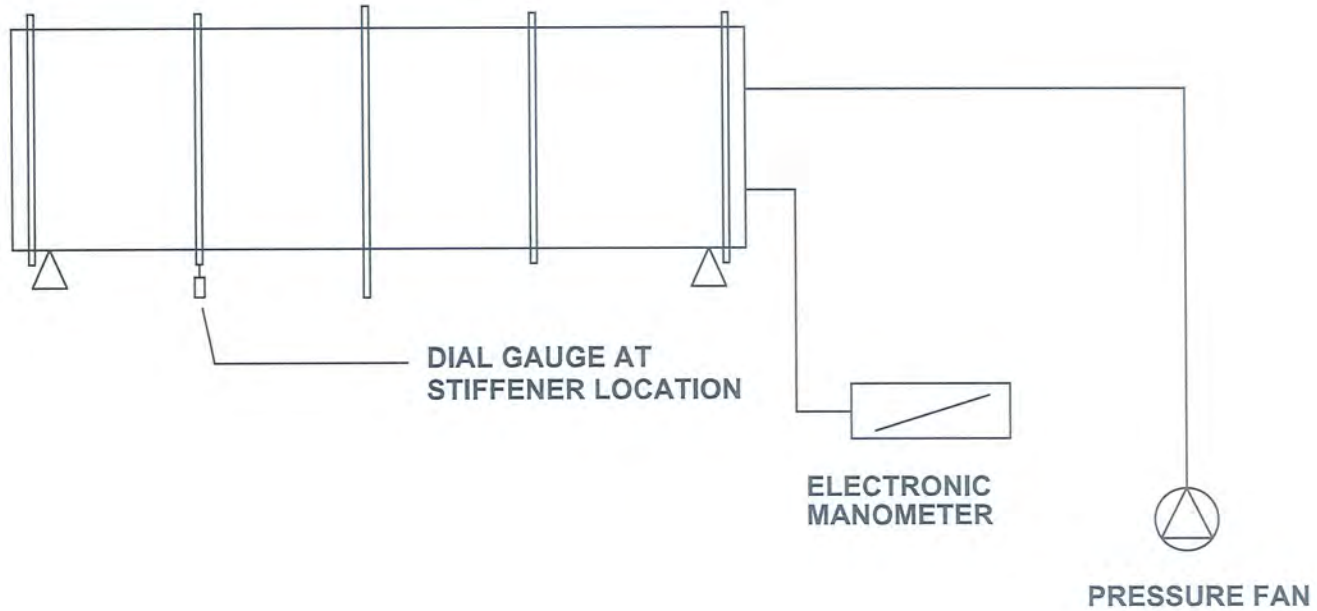
**Dwg No: 180329R10\_A**

** Campbell Shillinglaw Lau Ltd.**

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'YF' FLANGE STIFFENER  
DUCT SYSTEM



Title: Schematic Diagram of Stiffener Deflection Testing Set Up

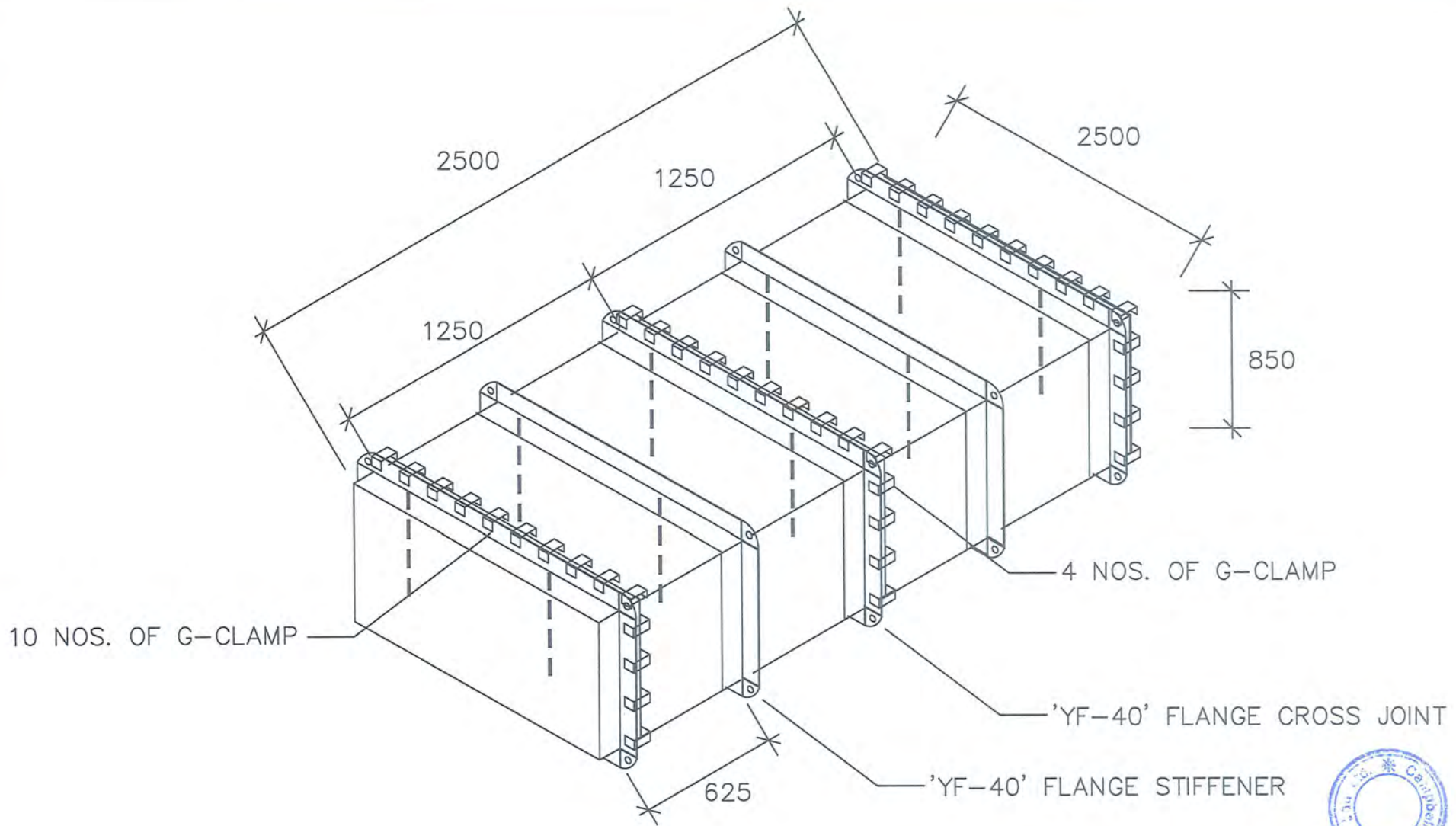
Scale: NTS

Date: 03/18

Dwg No: 180329R10\_B

 **Campbell Shillinglaw Lau Ltd.**

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Title: Specimen of Size 2500mm(L) x 2500mm(W) x 850mm(H) - High Pressure

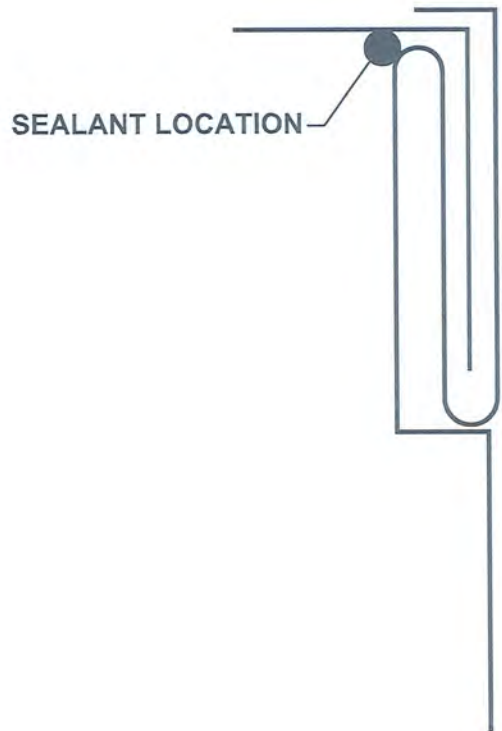
Scale: NTS

Date: 03/18

Dwg No: 180329R10\_C

 **Campbell Shillinglaw Lau Ltd.**

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Pittsburgh Lock Seam for Duct



Title: Pittsburgh Lock Seam for Duct

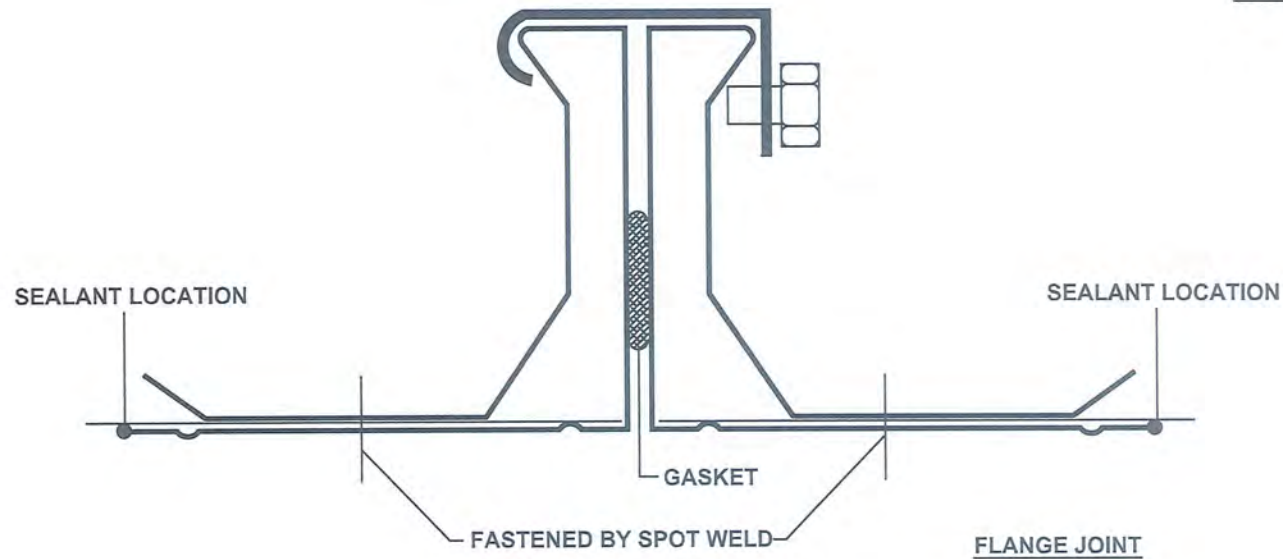
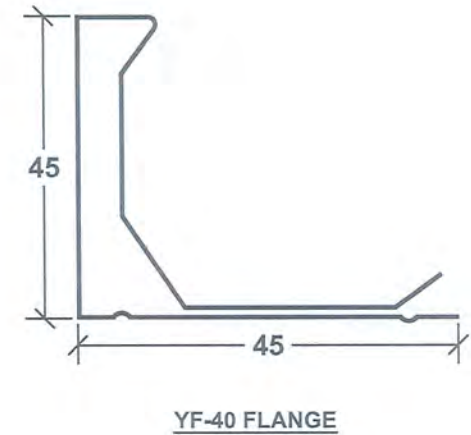
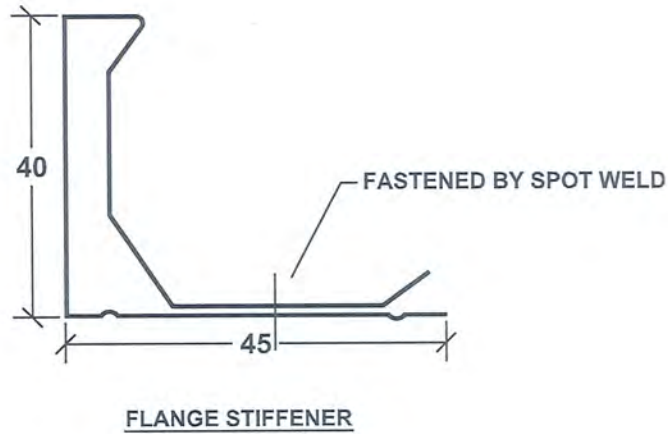
Scale: NTS

Date: 03/18

Dwg No: 180329R10\_D

 **Campbell Shillinglaw Lau Ltd.**

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Title: Detail of the Flange Joint (YF-40) & Flange Stiffener (YF-40)

Scale: NTS

Date: 03/18

Dwg No: 180329R10\_E

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