APPENDIX E

RUDDER SERVO CONTROL FUNCTIONAL TEST DATA SHEETS

TRW

SERVICE METHODES
METHOD DEPARTMENT

PROCES VERBAL DE RECETTE INDIVIDUELLE
ACCEPTANCE TEST REPORT

Désignation : Upper rudder servocontrol MSN 420 investigation
Description:

TYPE / P/N 31042-130 **N° DE SERIE** / S/N W1063

N° D'O.F. :

PLAN ES : 339781-502

PLAN EC : 339781-501

Réception suivant : Acceptance according: 339444-510 **Indice :** Issue: I1

Dérogations et Particularités : Concessions and Particulars:

Amendement : Amendment:

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under zero pressure			
Nutation Torque (CMM §13)			
C1 (piston side)	mdaN	0<C1<1	0,47 - No play
C2 (body side)	mdaN	0<C2<1	0 - With play
Force required to operate the input lever (CMM §6-1) – Test finger extended			
Extension	Kgf	5<f1<7	6 / 6.2
Retraction	kgf	5<f'1<7	6.3 / 6.2
Switch continuity			
Between A C	Ω	Not specified	Infinite
Between A B	Ω	Not specified	Infinite
Between C B	Ω	Not specified	0.54
Switch insulation			
Between B, ground	MΩ	> 20	35
Between C, ground	MΩ	> 20	62

Banc Bench

VISA

Opérateur Operator

DATE 15/03/2001

CONTROLE QUALITE / QUALITY INSPECTION
DELEGATION DE CONTROLE / INSPECTION'S
TRW A.S.G / TRW A.S.G

Poinçon / Stamp **Date**

Indice / Issue:	**Nom du rédacteur** / Editor name:	**Date de rédaction** / Date of writing:

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under pressure			
Finger test (CMM §1)			
Finger test extended	bar	2<P1<7	5.8
Finger test retracted	bar	10<P'1<30	13.8
Measurement of the gap between neutral position and fixed stop			
Piston side	mm	Not specified	7.71 / 7.70
Rudder side	mm	Not specified	8.19 / 8.10
External leakage		No leakage	No leakage
Setting of the input lever to the neutral position			
Dead travel (CMM §7)	mm	|X1-X2| < 0.18	0.06
Input lever travel between fixed stop (CMM §4-2)			
Extension	mm	8.51<L1<11.3	10.34
Retraction	mm	8.51<L2<11.3	9.61
Input lever travel between test stop (CMM §4-1)			
Retraction	mm	1.7<L1<5.96	5.1
Extension	mm	1.7<L2<5.96	3.65
Illumination of the microswitch – test stop			
Travel to illuminate the micro switch (from the finger test stops) (CMM §5-1)			
Retraction – l1	mm	1.06<Δl1<2.13	1.75
Extension – L'1	mm	1.06<ΔL'1<2.13	1.7
Travel to extinguish the micro switch (CMM §5-2)			
Retraction – l2	mm	ΔL1-0.5<Δl2<ΔL1	1.5
Extension – L'2	mm	ΔL'1-0.5<Δl'2<ΔL'1	1.5
Illumination of the microswitch – fixed stop (CMM §5-3)			
Retraction	mm	2.77<lr<8.08	4.95
Extension	mm	2.77<le<8.08	5.1
Force required to operate the input lever (CMM §6-1) – Test finger retracded			
Extension	N	f3<2	0.5
Retraction	N	f'3<2	0.3

TRW

SERVICE METHODES
METHOD DEPARTMENT

PROCES VERBAL DE RECETTE INDIVIDUELLE
ACCEPTANCE TEST REPORT

Désignation : Upper rudder servocontrol MSN 420 investigation
Description:

TYPE / P/N 31042-130 **N° DE SERIE** / S/N W1063

	Unité Unit	**Demande** Request	**Obtenu** Result
Overall travel of the servocontrol (CMM §8)			
206 bar	mm	C = 157 +0.55/-0.4	156.9
50 bar	mm		156.8
Internal leakage (CMM §11)			
Jet pipe consumption	cm^3/mn	350<Q1<450	**290**
Permanent consumption retraction	cm^3/mn	Q2	10
	cm^3/mn	Q2-Q1<200	300
middle	cm^3/mn	Q3	380
	cm^3/mn	Q3-Q1<400	90
extension	cm^3/mn	Q'2	300
	cm^3/mn	Q'2-Q1<200	10
Opening pressure of the by pass valve (without supply pressure)			
Applied in CA	bar	Not specified	7
Applied in CB	bar	Not specified	7
Flow rate of the calibrated damping ports with ΔP = 20 bar (CMM §2-1, 2-2)			
Extension	l/mn	10<Q<15	11.9
Retraction	l/mn	10<Q'<15	14.2
Opening pressure of the by pass valve with supply pressure (CMM §2-3, 2-4)			
Extension	bar	206<P2<216	209
Retraction	bar	206<P'2<216	212
Non return valve (CMM §3)	cm^3/mn	Q1<6	1

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit		**Demande** Request		**Obtenu** Result	
Pressure in chambers by applying 206 bar via the supply line						
CA	bar	N	P_A	F_A	205	10143
CB	bar	N	P_B	F_B	205	10143
Pressure in chambers allowing the piston to move						
Via CA	bar	N	P_{FB}	F_{FB}	0.3	15
Via CB	bar	N	P_{FA}	F_{FA}	0.25	12
Stall load (P_i + P_{Fi})						
CA	bar	N	P_A-P_{FA}	F_A-F_{FA}	204.75	10131
CB	bar	N	P_B-P_{FB}	F_B-F_{FB}	204.7	10128
Speeds of the servocontrol under 103 bars						
Intermediate speed						
Extension	mm/s		14.1<V<20.5		17.7	
Retraction	mm/s		14.1<V<20.5		19.8	
Maximum no load speed						
Extension	mm/s		86.8<V<120.2		119.5	
Retraction	mm/s		86.8<V<120.2		118.4	
Speeds of the servocontrol (CMM §12) under 206 bars						
Intermediate speed						
Extension	mm/s		20<V<29		25	
Retraction	mm/s		20<V<29		28	
Maximum no load speed						
Extension	mm/s		122.7<V<170		169	
Retraction	mm/s		122.7<V<170		167.5	

SERVICE METHODES METHOD DEPARTMENT	**PROCES VERBAL DE RECETTE INDIVIDUELLE** ACCEPTANCE TEST REPORT **Désignation : Middle rudder servocontrol MSN 420 investigation** Description: **TYPE** / P/N 31042-130 **N° DE SERIE** / S/N W487	**N° D'O.F. :** **PLAN ES : 339781-502** **PLAN EC : 339781-501**	**PAGE** 1 / 4

Réception suivant : Acceptance according: 339444-510	**Indice :** Issue: I1	**Dérogations et Particularités :** Concessions and Particulars:	**Amendement :** Amendment:

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under zero pressure			
Nutation Torque (CMM §13)			
C1 (piston side)	mdaN	0<C1<1	1.225 / 0.665
C2 (body side)	mdaN	0<C2<1	0.184 / 0.088
Force required to operate the input lever (CMM §6-1) – Test finger extended			
Extension	Kgf	5<f1<7	6.6
Retraction	kgf	5<f'1<7	6
Switch continuity			
Between A C	Ω	Not specified	Infinite
Between A B	Ω	Not specified	Infinite
Between C B	Ω	Not specified	0.54
Switch insulation			
Between B, ground	MΩ	> 20	30 000
Between C, ground	MΩ	> 20	25 000

Banc Bench		**VISA**		**CONTROLE QUALITE** / QUALITY INSPECTION **DELEGATION DE CONTROLE** / INSPECTION'S TRW A.S.G / TRW A.S.G
Opérateur Operator		**DATE**	19/03/2001	**Poinçon** / Stamp **Date**

Indice / Issue:	**Nom du rédacteur** / Editor name:	**Date de rédaction** / Date of writing:

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under pressure			
Finger test (CMM §1)			
Finger test extended	bar	2<P1<7	6.5
Finger test retracted	bar	10<P'1<30	14.0
Measurement of the gap between neutral position and fixed stop			
Piston side	mm	Not specified	7.89 / 7.88
Rudder side	mm	Not specified	7.80 / 8.04
External leakage		No leakage	No leakage
Setting of the input lever to the neutral position			
Dead travel (CMM §7)			
50 bar	mm	|X1-X2| < 0.18	0.08
206 bar			0.12
Input lever travel between fixed stop (CMM §4-2)			
Extension	mm	8.51<L1<11.3	10.0
Retraction	mm	8.51<L2<11.3	10.05
Input lever travel between test stop (CMM §4-1)			
Retraction	mm	1.7<L1<5.96	3.2
Extension	mm	1.7<L2<5.96	3.2
Illumination of the microswitch – test stop			
Travel to illuminate the micro switch (from the finger test stops) (CMM §5-1)			
Retraction – l1	mm	1.06<Δl1<2.13	**2.45**
Extension – L'1	mm	1.06<ΔL'1<2.13	**2.30**
Travel to extinguish the micro switch (CMM §5-2)			
Retraction – l2	mm	ΔL1-0.5<Δl2<ΔL1	2.15
Extension – L'2	mm	ΔL'1-0.5<Δl'2<ΔL'1	2.05
Illumination of the microswitch – fixed stop (CMM §5-3)			
Retraction	mm	2.77<lr<8.08	5.65
Extension	mm	2.77<le<8.08	5.5

TRW SERVICE METHODES METHOD DEPARTMENT	**PROCES VERBAL DE RECETTE INDIVIDUELLE** ACCEPTANCE TEST REPORT **Désignation : Middle rudder servocontrol MSN 420 investigation** Description: **TYPE** / P/N 31042-130 **N° DE SERIE** / S/N W487		**PAGE** 3 / 4

	Unité Unit	**Demande** Request	**Obtenu** Result
Force required to operate the input lever (CMM §6-1) – Test finger retracded			
Extension	N	f3<2	0.4
Retraction	N	f'3<2	0.9
Overall travel of the servocontrol (CMM §8)			
206 bar	mm	C = 157 +0.55/-0.4	156.95
50 bar	mm		156.8
Internal leakage (CMM §11)			
Jet pipe consumption	cm^3/mn	350<Q1<450	**300**
Permanent consumption retraction	cm^3/mn	Q2	310
	cm^3/mn	Q2-Q1<200	10
middle	cm^3/mn	Q3	660
	cm^3/mn	Q3-Q1<400	360
extension	cm^3/mn	Q'2	330
	cm^3/mn	Q'2-Q1<200	30
Opening pressure of the by pass valve (without supply pressure)			
Applied in CA	bar	Not specified	5.8
Applied in CB	bar	Not specified	5.6
Flow rate of the calibrated damping ports with ΔP = 20 bar (CMM §2-1, 2-2)			
Extension	l/mn	10<Q<15	12.4
Retraction	l/mn	10<Q'<15	14.3
Opening pressure of the by pass valve with supply pressure (CMM §2-3, 2-4)			
Extension	bar	206<P2<216	210
Retraction	bar	206<P'2<216	210
Non return valve (CMM §3)	cm^3/mn	Q1<6	1.5

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit		**Demande** Request		**Obtenu** Result	
Pressure in chambers by applying 206 bar via the supply line						
CA	bar	N	P_A	F_A	205	10143
CB	bar	N	P_B	F_B	205	10143
Pressure in chambers allowing the piston to move						
Via CA	bar	N	P_{FB}	F_{FB}	0.7	35
Via CB	bar	N	P_{FA}	F_{FA}	0.7	35
Stall load (P_i + P_{Fi})						
CA	bar	N	P_A-P_{FA}	F_A-F_{FA}	204.3	10108
CB	bar	N	P_B-P_{FB}	F_B-F_{FB}	204.3	10108
Speeds of the servocontrol under 103 bars						
Intermediate speed						
Extension	mm/s		14.1<V<20.5		18.6	
Retraction	mm/s		14.1<V<20.5		**20.8**	
Maximum no load speed						
Extension	mm/s		86.8<V<120.2		115.9	
Retraction	mm/s		86.8<V<120.2		115.5	
Speeds of the servocontrol (CMM §12) under 206 bars						
Intermediate speed						
Extension	mm/s		20<V<29		26.5	
Retraction	mm/s		20<V<29		**29.5**	
Maximum no load speed						
Extension	mm/s		122.7<V<170		164	
Retraction	mm/s		122.7<V<170		163.5	

TRW

SERVICE METHODES
METHOD DEPARTMENT

PROCES VERBAL DE RECETTE INDIVIDUELLE
ACCEPTANCE TEST REPORT

Désignation : Lower rudder servocontrol MSN 420 investigation
Description:

TYPE / P/N 31042-130 **N° DE SERIE** / S/N E9291

N° D'O.F. :

PLAN ES : 339781-502

PLAN EC : 339781-501

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Réception suivant : Acceptance according: 339444-510 **Indice :** Issue: I1

Dérogations et Particularités : Concessions and Particulars:

Amendement : Amendment:

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under zero pressure			
Nutation Torque (CMM §13)			
C1 (piston side)	mdaN	0<C1<1	0.1 / 0.12 - No play
C2 (body side)	mdaN	0<C2<1	0 - Light play
Force required to operate the input lever (CMM §6-1) – Test finger extended			
Extension	Kgf	5<f1<7	6.4
Retraction	kgf	5<f'1<7	5
Switch continuity			
Between A C	Ω	Not specified	Infinite
Between A B	Ω	Not specified	Infinite
Between C B	Ω	Not specified	0.57
Switch insulation			
Between B, ground	MΩ	> 20	580
Between C, ground	MΩ	> 20	600

Banc Bench

VISA

Opérateur Operator

DATE 19/03/2001

CONTROLE QUALITE / QUALITY INSPECTION
DELEGATION DE CONTROLE / INSPECTION'S
TRW A.S.G / TRW A.S.G

Poinçon / Stamp **Date**

Indice / Issue:	**Nom du rédacteur** / Editor name:	**Date de rédaction** / Date of writing:

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit	**Demande** Request	**Obtenu** Result
Test under pressure			
Finger test (CMM §1)			
Finger test extended	bar	2<P1<7	6.8
Finger test retracted	bar	10<P'1<30	14.6
Measurement of the gap between neutral position and fixed stop			
Piston side	mm	Not specified	8.13 / 7.9
Rudder side	mm	Not specified	7.73 / 7.68
External leakage		No leakage	No leakage
Setting of the input lever to the neutral position			
Dead travel (CMM §7)			
50 bar	mm	|X1-X2| < 0.18	0.04
206 bar			0.08
Input lever travel between fixed stop (CMM §4-2)			
Extension	mm	8.51<L1<11.3	9.76
Retraction	mm	8.51<L2<11.3	10.26
Input lever travel between test stop (CMM §4-1)			
Retraction	mm	1.7<L1<5.96	4.2
Extension	mm	1.7<L2<5.96	2.76
Illumination of the microswitch – test stop			
Travel to illuminate the micro switch (from the finger test stops) (CMM §5-1)			
Retraction – l1	mm	1.06<Δl1<2.13	**2.4**
Extension – L'1	mm	1.06<ΔL'1<2.13	**2.24**
Travel to extinguish the micro switch (CMM §5-2)			
Retraction – l2	mm	ΔL1-0.5<Δl2<ΔL1	2.05
Extension – L'2	mm	ΔL'1-0.5<Δl'2<ΔL'1	1.94
Illumination of the microswitch – fixed stop (CMM §5-3)			
Retraction	mm	2.77<lr<8.08	6.6
Extension	mm	2.77<le<8.08	5

TRW SERVICE METHODES METHOD DEPARTMENT	**PROCES VERBAL DE RECETTE INDIVIDUELLE** ACCEPTANCE TEST REPORT **Désignation : Lower rudder servocontrol MSN 420 investigation** Description: **TYPE** / P/N 31042-130 **N° DE SERIE** / S/N E929		**PAGE** 3 / 4

	Unité Unit	**Demande** Request	**Obtenu** Result
Force required to operate the input lever (CMM §6-1) – Test finger retracded			
Extension	N	f3<2	0.65
Retraction	N	f'3<2	0.55
Overall travel of the servocontrol (CMM §8)			
206 bar	mm	C = 157 +0.55/-0.4	157.1
50 bar	mm		156.9
Internal leakage (CMM §11)			
Jet pipe consumption	cm^3/mn	350<Q1<450	**0 / 0 / 60**
Permanent consumption retraction	cm^3/mn	Q2	170
	cm^3/mn	Q2-Q1<200	170 / 170 /110
middle	cm^3/mn	Q3	590
	cm^3/mn	Q3-Q1<400	**590 / 590 / 530**
extension	cm^3/mn	Q'2	150
	cm^3/mn	Q'2-Q1<200	150 / 150 / 90
Opening pressure of the by pass valve (without supply pressure)			
Applied in CA	bar	Not specified	6
Applied in CB	bar	Not specified	5.6
Flow rate of the calibrated damping ports with ΔP = 20 bar (CMM §2-1, 2-2)			
Extension	l/mn	10<Q<15	12.09
Retraction	l/mn	10<Q'<15	14.4
Opening pressure of the by pass valve with supply pressure (CMM §2-3, 2-4)			
Extension	bar	206<P2<216	210
Retraction	bar	206<P'2<216	210
Non return valve (CMM §3)	cm^3/mn	Q1<6	1.5

Pour vérification et approbation de la création et des évolutions, voir la fiche des évolutions : J24-T
For checking and approval of the creation and evolution, see evolution sheet J24-T

J05-T3

	Unité Unit		**Demande** Request		**Obtenu** Result	
Pressure in chambers by applying 206 bar via the supply line						
CA	bar	N	P_A	F_A	204	10094
CB	bar	N	P_B	F_B	205	10143
Pressure in chambers allowing the piston to move						
Via CA	bar	N	P_{FB}	F_{FB}	0.85	42
Via CB	bar	N	P_{FA}	F_{FA}	1.15	57
Stall load (P_i + P_{Fi})						
CA	bar	N	P_A-P_{FA}	F_A-F_{FA}	202.85	10086
CB	bar	N	P_B-P_{FB}	F_B-F_{FB}	203.15	10052
Speeds of the servocontrol under 103 bars						
Intermediate speed						
Extension	mm/s		14.1<V<20.5		18.0	
Retraction	mm/s		14.1<V<20.5		**20.7**	
Maximum no load speed						
Extension	mm/s		86.8<V<120.2		112.6	
Retraction	mm/s		86.8<V<120.2		112.8	
Speeds of the servocontrol (CMM §12) under 206 bars						
Intermediate speed						
Extension	mm/s		20<V<29		25.5	
Retraction	mm/s		20<V<29		**29.3**	
Maximum no load speed						
Extension	mm/s		122.7<V<170		159.3	
Retraction	mm/s		122.7<V<170		159.5	