

TITOLO – TITLE

GENERATOR DATA SHEET

0 EMESSO - ISSUED	EC			03/03/2009
DESCRIZIONE - DESCRIPTION	PREP'D	CONT-CHK'D	APP- APPR'D	DATA – DATE
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1. GENERAL DATA

Item.....

LanguageEnglish

Reference Codes.....

General specificationsITN62010/A (latest revision), SOK7260891/4 (latest revision) & additional specifications (refer to para. 11)

Tests.....refer to general specification and para. 12

Technical documentationSOK7260641/4 (latest revision) and general specification

General single line diagram.....SOK4410546

Electric interfaces signal listSOK4413933

MarkingCE (+ATEX for instrumentation)

3rd party certification.....required by independant authority for Generator and AVR panel

DNV certification.....To be quoted as option for Generator and AVR panel

2. SITE CONDITIONS

The generator will be installed on FPSO with the following main characteristics:

Environmentindustrial, marine, salty, arctic

Corrosive elementsnot applicable

Altitude.....<1000 m

Topside motion designAcc. To spec. 3203-T-AKT-R-SA-00-0002-00 with following update:

Note: 4 meter above deck is the location of the main generator skid.

SUMMARY OF MOTIONS AND ACCELERATIONS FOR TOPSIDES PIPING AND EQUIPMENT

GENERAL	UNITS	
Roll angle	Deg	11.40
Roll Period	Sec	20.80
Pitch angle	Deg	9.40
Pitch period	Sec	9.90
Min trin	Deg	0.00
Max trim	Deg	1.00

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Frame (TU15)	EL over ship deck(m)	4.00	12.00	16.00	17.3(frame 58)
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TRANSIT CONDITION ULS (10 YR RETURN)

Longitudinal	m/sec^2	1.82	2.22	2.42	2.49
Trasverse	m/sec^2	3.05	3.15	3.20	3.25
Vertical	m/sec^2	4.22	4.22	4.22	4.46

OPERATIONAL ULS (100 YR RETURN)

Longitudinal	m/sec^2	1.85	2.26	2.47	2.53
Trasverse	m/sec^2	3.47	3.64	3.73	3.85
Vertical	m/sec^2	4.80	4.80	4.80	5.17

ACCIDENTAL ALS (10000 YR RETURN)

Longitudinal	m/sec^2	1.98	2.32	2.51	2.55
Trasverse	m/sec^2	5.76	6.08	6.23	6.32
Vertical	m/sec^2	5.16	5.16	5.16	5.19

Wind speedNot applicable

Design temperature(min/max).....-6 / +50 °C

Ambient temperature range min/max.....-6 / +23 °C

Relative humidity80 %

Area classificationSafe (Instruments and relevant JB's suitable for installation in Zone 1 Group II B T3).

3. ELECTRIC NETWORK DATA

Grid rated voltage.....11000 V ± 5%

Maximum fault levellater MVA

Connection to networkDirect

Step-up transformer ratio.....Not applicable

Step-up transformer rating.....Not applicable

Step-up transformer impedance voltage.....Not applicable

4. OPERATION REQUIREMENTS

Island running.....Required

Parallel running with external network.....Not required

Parallel running with other generatorsRequired

Running supervision.....Unattended

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5. GENERATOR DATA

Manufacturer	Brush Electrical Machi Ltd.
Type.....	BDAX 62.195ERH
Rated power @water temperature 16°C.....	29700 kVA
Rated power factor (overexcited)	0.8
Rated power factor (underexcited).....	0.95 as minimum
Rated voltage.....	11000 V (tolerance acc. to IEC34-1
Rated frequency.....	60 Hz (tolerance acc. to IEC34-1
Rated current	1558.8A
Output power versus coolant temperature curve	Not applicable
Number of phases.....	3
Location of line leads (facing from DE)	Left
Location of neutral leads (facing from DE)	Right
Number of poles	2
Rated speed.....	3600 rpm
Overspeed.....	4320 rpm
Insulation class	F
Winding temperature (at rated power)	within class B
Max. total temperature stator/rotor.....	125/130°C
Number of main terminals.....	6
Sound pressure level @ 1 m (FSNL condition)	85 dB(A)
Sound pressure level @ 1 m (expected at FSFL condition).....	88 dB(A)
Vibration limits at site	ISO10816
Vibration limits (acceptance at Manufacturer workshop).....	IEC34-14
Protection degree	IP55 (IP56 for J.Boxes)
Type of construction.....	IM1005
Cooling type	ICW71
Neutral.....	Grounded see para. 6.3
Rotation direction facing the generator from (main) DE	CCW (Counterclockwise)
Generator phase sequence	U-V-W
Bearing type.....	Sleeve
Bearing housing type.....	End shield
Bearing lifting provision.....	Not required
Thrust bearing.....	Required
Lubrication	Forced
Paint requirement.....	Manufacturer standard for Offshore
Final colour.....	RAL9002
Certificate of conformity.....	3 rd party certification acc. To IEC required. ATEX certification for instruments and relevant JB's.

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5.1. Excitation system

Type.....Brushless
 Supply.....PMG
 Current boosting (referred to rated current).....300% lasting 10 sec

5.2. Voltage regulator (NOT INCLUDED)

Manufacturer and model Brush / Prismic A30
 Regulator type Automatic and manual
 Installation.....In separate free-standing cubicle
 (Generator Excitation Panel)
 Panel dimensions (L x W x H)800x850x2100 mm
 Protection degree.....IP41
 Cable entryBottom
 Nameplates on Generator excitation panelWhite background with engraved
 black
 letters acc. To 3203-T-AKT-R-SA-
 00-
 0002-00 para. 4.9
 Redundant control supplyrequired 230Vac 60Hz from UPS
 Generator excitation panel final colour.....RAL9002

AVR & protection functions:

Excitation compensation with ambient temperature....Not required
 Over and underexcitation limitsRequired
 V/f ratio automatic controlRequired
 Generator/plant power factor automatic regulationRequired
 Reference set point for plant p.f. regulation4-20 mA
 Reactive power automatic regulation.....Required
 Reactive power automatic sharingRequired (Cross current
 compensation)
 Droop/constant voltage operationRequired
 Excitation Voltage/Current 4-20mA output signalsRequired
 Power system stabilizerNot required
 Rotor earth fault relayRequired
 Rotating diodes failure detectionRequired
 Voltage increase 10% before large motor starting.....Required

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5.3. Terminal boxes

5.3.1. Line side cubicle

- Position (facing from DE)..... Left
- Material..... Stainless steel AISI 316L
- Bus duct connection..... Not applicable
- Cable connection N°4 cables 1x 300 mm² per phase
- Cable entry.....Bottom by MCT frames and rubbers to be included in the supply.
- Space for CTsRequired see para. 6.1.1
- Space for PTs..... Required see para. 6.2
- Surge capacitors and lightning arresters.. Required
- Cable terminationsNot required
- Stress relieving conesNot required
- Anticondensation heaters.....Required – 230Vac 1Ph+N 60Hz
- Breather and Drain..... Required
- Handles on removable platesRequired if terminal box cover plate dimensions exceed 300 mm x 250 mm (length x height)
- Supporting structure.....Required if necessary
- Lifting lugs.....Required
- Protection degreeIP56
- Provision for installation of IRIS condition monitoring system Required

5.3.2. Star point side cubicle

- Position (facing from DE)..... Right
- Material..... Stainless steel AISI 316L
- Cable connection N° 1x300 mm²
- Cable entry.....Bottom by MCT frames and rubbers to be included in the supply.
- Space for CTsRequired see para. 6.1.1
- Space for neutral grounding equipment... Required see para. 6.3
- Cable terminations..... Not required
- Stress relieving conesNot required
- Anticondensation heaters.....Required – 230Vac 1Ph+N 60Hz
- Breather and Drain..... Required

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Handles on removable plates Required if terminal box cover plate
 dimensions exceed 300 mm x 250 mm
 (length x height)
 Lifting lugs..... Required
 Protection degree IP56

5.3.3. Auxiliary junction box

Position (facing from DE)..... Left
 Cable entry..... Bottom (by non-magnetic, removable undrilled
 gland plate)
 Material..... SS AISI 316L
 Drain and breather Required
 JB's separation Control, Vibration, Power, PSD and ESD
 Separate JBs for IS circuits Required
 Protection degree IP56

5.3.4. Additional requirements

Line and Neutral cubicles mounted on the Generator frame

5.4. Cooling system

Water-cooled
 Coolant type Sea water
 Glycol content %
 Inlet temperature min/max 4.9/16 °C
 Design water temperature -6/23 °C
 Allowed temperature rise 9.5°C
 Design Pressure 19 bar
 Operating pressure 10 bar
 Allowed water pressure drop 1 bar
 Cooling water flow..... 14 Litres/second
 Number of cooler sections 4 (four)
 Cooler position Top
 Power output with one section out of service 70% (class B temperatures)

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Fouling factor..... m²K/Kcal
 Inlet and outlet flange location (facing from DE)... Right
 Cooling water heat rejection 545kW @23°C

5.5. Lube oil system (NOT INCLUDED)

Oil type..... ISO VG 32
 Supply temperature max /normal /min..... 55 / 45 / 20 °C
 Mechanical design temperature..... 100 °C
 Supply pressure min/normal..... 0.9/1.72 bar
 Mechanical design pressure inlet/outlet 12 bar
 Test pressure inlet/outlet 18 bar
 Oil flow 114 l/min (total for generator)
 Oil heat rejection..... 23500 kCal/h (total for generator)
 Maximum allowable backpressure..... 0.003 bar
 Bearing vent Required if necessary
 Filtering degree 25 micron abs.
 Piping connection to provide a common Inlet/Outlet interface flange
 (including both Generator bearings + Gearbox) Not required
 Inlet/Outlet flange location (facing from DE)..... Left
 Inlet/Outlet connection flange rating ANSI B 16.5 / ANSI B 16.5
 Piping material SS316 L
 Project Lube Oil Line Specification SOM _____

5.6. Auxiliary supply

The following power supplies are available for excitation control panel and generator auxiliary:

- Power supply for LV motors 690V, 3ph, 60 Hz
- Power supply for heaters >3kW..... 690V, 3ph, 60 Hz
- Power supply for heaters <3kW..... 400V, 3ph, 60 Hz
- Power supply for control..... 230Vac , 1 ph, 60Hz - Redundant
- Power supply for single phase utility..... 230 V, 1 ph, 60 Hz

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6. M.V. EQUIPMENT

Voltage class.....17.5 kV
 Power frequency withstand voltage.....38 kV
 Impulse withstand voltage.....95 kV
 Rated short time current (1 sec)40 kA
 Rated momentary current (peak) Ka

6.1. Current transformers (NOT INCLUDED)

6.1.1. Star point side

N° 1 set of 3 CT's with 2 secondaries
 Ratio.....2000 / 1 / 1 A
 Burden and accuracy class
 Core for protection relays.....15 VA - 5P20
 Core for measures.....15 VA - cl. 0.5 Fs5

6.1.2. Line side

N° 1 sets of 3 CT's with 2 secondaries to be supplied loose for installation in
 Customer switchgear:
 Ratio.....2000 / 1 / 1 A
 Burden and accuracy class
 Core for generator differential protection15 VA - 5P20
 Core for metering15 VA - cl. 0.5 Fs5

6.1.3. Neutral grounding side

N° of CT's.....1
 Ratio.....20 / 1 A
 Burden and accuracy class
 Core for protection relay.....15 VA - 5P10

6.1.4. CT's for current reference to the voltage regulator Required

6.1.5. CT's for excitation boosting in case of short circuit Not required

6.1.6. CT for cross current compensation..... Required

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6.2. Voltage transformers (NOT INCLUDED)

- 6.2.1.** Measures and protections Required
 - N° 1 sets of 3 PT's with 2 secondaries
 - Ratio.....11000 / 110 / 110 V
 - $\sqrt{3}\sqrt{3}\sqrt{3}$
 - Burden and accuracy class
 - Core for measures+AVR.....30 VA - cl. 0.5
 - Core for generator protection30 VA - 3P

6.2.2. PT's for voltage reference to the voltage regulator Included in 6.2.1

6.2.3. Excitation transformerNot required

Each PT secondary shall be equipped by automatic circuit breaker with auxiliary contacts for remote indication (minimum 1 N.O. + 1 N.C.) according to single line diagram.

6.3. Neutral grounding equipment

- Rated current (MV side) 20 A lasting 10 sec
- Continuous rating (MV side) _____ A
- Rated voltage..... $11/\sqrt{3}$ kV
- Installation..... Inside star point terminal box
- Enclosure protection degree..... IP56
- MV resistor _____ Ω
- Grounding transformer ratio Not applicable
- Grounding transformer rated power..... Not applicable
- Grounding transformer type.....Not applicable
- Earthing SwitchNot required

7. ACCESSORIES

- Anticondensation heater.....Rating 4 kW690 V 3ph 60Hz
- Winding temperature detectorsN°9 duplex RTD
- Bearing (white metal) temperature detectorsN°1 duplex RTD
- Cooling air temperature detectorsN°3 duplex RTD
- Inlet cooling air temp. detector for excitation compensation.....Not required
- Lube oil thermometers.....N°1 for each bearing
- Lube oil thermostats.....Not required
- Lube oil inlet orifice DE/NDERequired

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Water leakage detector.....Required

NameplatesStainless Steel, fixed by means of SS wire or screw.

Fitting & tubing type & ManufacturerAcc. To customer spec. 3203-T-AKT-RSA-00-0002-00 para. 4.6

Fitting & tubing materialAcc. To customer spec. 3203-T-AKT-RSA-00-0002-00 para. 4.6

Anchoring bolts, shims and alignment devices (vertical/horizontal)...Not Required

Coupling bolts (with Turbine flange).....Not Required

LS shaft coupling guard fixing flange.....Required

Seismic detectorsN° 1 velocity sensors per bearing, model BN330500, complete of suitable transducer housing

Proximity Transducer SystemN° 2 complete Proximity Transducer Systems X-Y per bearing, model BN series 3300 XL, complete of suitable transducer housing

Key phasor.....Required

Rotor withdrawal special toolsRequired – Including withdrawal GEAR (No station crane available at site)

Number of rotor tools per site 1

Jacking oil system.....Option Required (N° ___ electric motor: Rated Power = ___ kW, Rated Voltage = 690 Vac, 3ph, 60 Hz IP56) including all accessories as Pressure transmitters, pressure relief valves, tubing

Jacking oil system provisionRequired for future installation.

Bolting materialsAcc. To customer spec. 3203-T-AKTR-SA-00-0002-00 para. 2.10

Commissioning and start up spare parts.....Required

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8. DRIVING MACHINE DATA

Machine typeGas turbine
 ManufacturerNuovo Pignone
 Type.....LM2500
 CouplingDirect
 Speed3600 rpm
 Inertia ($J=WR_2$ @ rpm) Kgm²

9. SPEED REDUCTION GEAR DATA

Generator will be directly coupled to Gas Turbine trough flexible joint.

10. TECHNICAL DATA

10.1. Electrical data

Data based on rated KVA and kV at rated temperature (29.7MVA, 11kV).

Short circuit ratio (K_o) 0.68
 Direct synchronous reactance (saturated) (X_{dv}) 1.47 pu
 Direct synchronous reactance (unsaturated) (X_{di})..... 1.79 pu
 Quadrature axis synchronous reactance (saturated)(X_{qv}) 1.18 pu
 Quadrature axis synchronous reactance (unsaturated) (X_{qi})..... 1.64 pu
 Direct axis transient reactance (saturated) (X'_{dv})..... **0.16** pu
 Direct axis transient reactance (unsaturated) (X'_{di}) 0.19 pu
 Direct axis sub-transient reactance (saturated) (X''_{dv}) 0.112 pu
 Direct axis sub-transient reactance (unsaturated) (X''_{di})..... 0.142 pu
 Quadrature axis transient reactance (unsaturated) (X'_{qi}) 0.28 pu
 Quadrature axis sub-transient reactance (saturated) (X''_{qv})0.14 pu
 Quadrature axis sub-transient reactance (unsaturated) (X''_{qi})..... 0.17 pu
 Negative sequence reactance (saturated) (X_{2v})0.109 pu
 Negative sequence reactance (unsaturated) (X_{2i})..... 0.138 pu
 Zero sequence reactance (saturated) (X_{0v})0.063 pu
 Zero sequence reactance (unsaturated) (X_{0i})..... 0.063pu
 Potier reactance (X_p) 0.165 pu
 Leakage reactance (overexcited)..... (X_{lmoex}) 0.070 pu
 Leakage reactance (underexcited)..... (X_{lmuex}) 0.070 pu
 Positive sequence resistance at rated current @ 75°C/125°C..... (R_1)..... 0.0055/0.0064 pu
 Negative sequence resistance at rated current @ 75°C/125°C ... (R_{2i}) 0.0245/0.0284 pu
 Zero sequence resistance at rated current @ 75°C/125°C (R_{0i}) 0.0082/0.0096pu
 Armature windings D.C. resistance @ 100°C..... (R_a)..... 0.0019/--- pu
 Armature windings D.C. resistance @ 75°C/125°C (R_{a1})0.0018/0.0021pu

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Excitation windings D.C. resistance @ 75°C/125°C..... (R_f) 0.033/0.038 pu
Rotor iron resistance (R_i) 0.00012 pu
Direct axis short circuit transient time constant..... (T'_d) 0.56 sec
Direct axis three-phase short circuit transient time constant (T'_{d3}) 0.56 sec
Direct axis line-to-line short circuit transient time constant..... (T'_{d2}) 1.10 sec
 Direct axis line to neutral short circuit transient time constant ... (T'_{d1}) 1.31 sec
Direct axis open circuit transient time constant @ 125°C..... (T'_{do}) 5.5 sec
Direct axis open circuit transient time constant @ 100°C..... (T'_{do1}) 5.9 sec
Quadrature axis short circuit transient time constant..... (T'_q) 0.28 sec
Quadrature axis open circuit transient time constant (T'_{qo}) 2.4 sec
Direct axis short circuit sub-transient time constant..... (T''_d)..... 0.04 sec
Direct axis open circuit sub-transient time constant..... (T''_{do})..... 0.05 sec
Quadrature axis short circuit sub-transient time constant..... (T''_q)..... 0.04 sec
Quadrature axis open circuit sub-transient time constant..... (T''_{qo})..... 0.05 sec
Armature short circuit time constant..... (T_a) 0.20 sec
Armature three phase short circuit time const. @ 100°C/125°C (T_{a3}) 0.15/0.14 sec
Armature line to line short circuit time const. @ 100°C/125°C..... (T_{a2}) 0.15/0.14 sec
Armature line to neutral short circuit time const @ 100°C/125°C... (T_{a1}) 0.13/0.12 sec
Excitation windings open circuit time constant (T_{fdo})..... 7.8 sec
Excitation windings short circuit time constant (T_{fd}) 0.56 sec
Damping equivalent circuit open circuit time constant (T_{kdo}) 0.05 sec
Damping equivalent circuit short circuit time constant (T_{kd}) 0.04 sec
Stator windings thermal time constant..... (T)..... 45 min
Rotor windings thermal time constant (T_j) 30 min
Rotor short time thermal capacity (I_r)_{2t} 33
Generator phase capacitance to ground 0.11 μF
Three phase short circuit current at full load (peak value) 13.6 pu
Three phase short circuit current at full load (max rms value) 9.6 pu
Three phase short circuit current at full load (steady state rms value) 3.0 pu

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10.2.Mechanical data

Constant of inertia (H) (based on Generator only shaft inertia)	0.89 kWsec/KVA
Generator inertia ($J=WR_2$)	370 Kgm ²
Shaft end torsional stiffness (coupling side).....	2.3E7 Nm/rad
Shaft material yield strength	510 Mpa
(Shall be ≥ 460 Mpa)	
Thrust load during operation.....	-- kN
First/Second critical speed	_____ rpm
Allowable axial displacement (internal/external) from magn. center.....	+/- _____mm
Shaft elongation (from cold to operating conditions)	3 mm
Generator rated torque	63 kNm
Breakaway start-up torque (if Jacking oil is not provided).....	2.4 kNm
Vibration at full load (rms value).....	2.8 mm/sec
Bearing type	Sleeve
Bearing diameter DE/NDE.....	200 mm
Bearing length DE/NDE.....	148 mm
Bearing static load DE/NDE	40,000 N
Bearing journal displacement (from cold to operating conditions)	0.5 mm
Bearing maximum allowable load.....	_____N
Bearing pressure.....	13.8 Kg/cm ²
Bearing oil supply pressure.....	1.5 bar
Bearing oil inlet/outlet temperature	54 °C
Bearing max. temperature	95 °C
Bearing stiffness and damping coefficients Vs rotating speed (from 800 up to 1.5 times operating speed)	To be provided (see relevant document, item 21 required on para. 13)
Air gap.....	29 mm

10.3.Dimensions

Length.....	6079 mm
Width.....	2200 mm
Height.....	3000 mm
Rotor withdrawal distance from generator centerline.....	8000 mm

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10.4.Weights

Stator 29500 Kg
 Rotor..... 8170 Kg
 Total 46050 Kg
 Max weight for lifting (Generator less cooler) 46100 Kg
 Max weight for transportation (Generator less cooler)..... 46100 Kg

10.5.Excitation equipment

10.5.1. Generator field

Field excitation current at full load 802 A
 Field excitation voltage at full load 127 V

10.5.2. Exciter

Manufacturer and model..... Brush / BX 10.13-3S
 Rated power..... 123 kW
 Exciter current at full load 882 A
 Exciter voltage at full load..... 140 V
 Rated frequency..... 180 Hz

10.5.3. PMG

Manufacturer and model..... Brush/MXI 44.07-A1
 Rated power..... 3.6 KW
 Rated current..... 15 A
 Rated voltage 240 V
 Rated frequency..... 480 Hz

10.5.4. Excitation system performances (with A.V.R. in operation)

Excitation system response speed..... 2.9 sec-1
 Ceiling value at full load..... 228 V
 Max transient over voltage at 25 % step load increase..... _____
 Max transient over voltage at 100% load rejection..... 14 %
 Max voltage drop at _____ kW motor starting..... _____ %
 Recovery time at _____ kW motor starting..... _____ sec

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10.6.Losses

Conventional ventilation losses at rated speed	110 kW
Friction losses in the bearings.....	27 kW
Stator copper losses at rated power (at 75°C/95°C).....	53/57 kW
Rotor copper losses at rated power (at 75°C/95°C)	87/92 kW
Iron losses at rated voltage and frequency	112 kW
Excitation losses.....	7 kW
Additional losses	108 kW
Total conventional losses at rated power	513 kW
Iron losses at 1.1 U _n	172 kW
Generator heat rejection in the ambient air (for enclosure ventilation sizing)	15 kW

10.7.Efficiency

Load.....	100 %	75 %	50 %	25 %
Efficiency @ rated p.f.(0.8)	97.89%	97.75%	97.26%	95.39%
Efficiency @ 1.0 p.f.	98.37%	98.14%	97.55%	95.60%
Guarantee on efficiency	Required			

10.8.Other characteristics

Telephonic harmonic factor	(THF).....	1.5 %
Telephonic influence factor	(TIF)	70/50%
Phase to phase voltage distortion factor.....	(K _d)	0.5% typical
Phase to ground voltage distortion factor	(K' _d).....	5% typical
Continuous permissible negative sequence current	(I ₂)	0.15 pu
Max. (I ₂ /I _n) _{2 t}		30

_____ Bidder to fill in and attach to the offer.

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