DIN EN ISO 13628-6

DIN

ICS 75.180.10

Entwurf

Einsprüche bis 2012-04-27
Vorgesehen als Ersatz für
DIN EN ISO 13628-6:2008-01

Erdöl- und Erdgasindustrie – Auslegung und Betrieb von Unterwasser-Produktionssystemen – Teil 6: Steuersysteme für die Unterwasser-Produktion (ISO/DIS 13628-6:2011); Englische Fassung prEN ISO 13628-6:2012, nur auf CD-ROM

Petroleum and natural gas industries – Design and operation of subsea production systems – Part 6: Subsea production control systems (ISO/DIS 13628-6:2011); English version prEN ISO 13628-6:2012, only on CD-ROM

Industries du pétrole et du gaz naturel – Conception et exploitation des systèmes de production immergés – Partie 6: Commandes pour équipements immergés (ISO/DIS 13628-6:2011); Version anglaise prEN ISO 13628-6:2012, seulement en CD-ROM

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2012-02-27 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfes besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise als Datei per E-Mail an noeg@din.de in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/stellungnahme oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder online im Norm-Entwurfs-Portal des DIN unter www.entwuerfe.din.de, sofern dort wiedergegeben;
- oder in Papierform an den Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) im DIN, 10772 Berlin (Hausanschrift: Burggrafenstr. 6, 10787 Berlin).

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 155 Seiten

Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) im DIN

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

Nationales Vorwort

Dieses Dokument (prEN ISO 13628-6:2012) wurde vom Technischen Komitee ISO/TC 67/SC 4 „Drilling and production equipment“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 12 „Materialien, Ausrüstungen und Offshore-Bauwerke für die Erdöl-, petrochemische und Erdgasindustrie“ (Sekretariat: AFNOR, Frankreich) erarbeitet.

Für Deutschland hat hieran der Arbeitskreis NA 109-00-01-04 AK „Bohr- und Fördereinrichtungen - Spiegelausschuss zu ISO/TC 67/SC 4“ im Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) des DIN Deutsches Institut für Normung e. V. mitgearbeitet.

Das Ausgabedatum des Europäischen Norm-Entwurfs stand zum Zeitpunkt der Veröffentlichung dieses DIN-EN-ISO-Entwurfs noch nicht fest; der prEN ISO wird jedoch vom CCMC unter der angegebenen prEN-Nummer demnächst zur CEN-Umfrage verteilt. Um der deutschen Öffentlichkeit eine möglichst lange Einspruchsfrist einzuräumen, wurde dieser Norm-Entwurf bereits vorab veröffentlicht.

Dieses Dokument enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 1/2004 nur die englische Originalfassung von EN ISO 13628-6.

Dieses Dokument enthält neben den gesetzlichen Einheiten auch die Einheiten „°F“, „atm“, „ft“ „in (inch)“, „lb (pound)“, „P“, „ppm“, „psi (psig)“ und „r/min“ die in Deutschland nicht zugelassen sind. Es wird ausdrücklich darauf hingewiesen, dass die Anwendung dieser Einheit im nationalen amtlichen und geschäftlichen Verkehr aufgrund des Gesetzes über Einheiten im Messwesen nicht zulässig ist.

Umrechnung:

Nicht-SI-Einheit	**SI-Einheit**	**Umrechnung**	
°F	°C	°C	= (5/9) (°F-32)
atm	Pa	1 atm	= $1{,}01325 \cdot 10^5$ Pa
ft	m	1 ft	= 0,304 8 m
in (inch)	mm	1 inch	= 25,4 mm
lb (pound)	kg	1 lb	= 0,453 592 37 kg
P	$N \cdot s/m^2$	1 P	= $0{,}1\ N \cdot s/m^2$
ppm	mg/kg	1 ppm	= 1 mg/kg
psi (psig)	kPa	1 psi	= 6,894 757 kPa
r/min	min^{-1}	1 r/min	= $1\ min^{-1}$

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

Für die in diesem Dokument zitierten Internationalen Normen wird im Folgenden auf die entsprechenden Deutschen Normen hingewiesen:

ISO 9606-1	siehe	DIN EN 287-1
ISO 9606-2	siehe	DIN EN ISO 9606-2
ISO 10423	siehe	DIN EN ISO 10423
ISO 15607	siehe	DIN EN ISO 15607
ISO 15609-2	siehe	DIN EN ISO 15609-2
ISO 15610	siehe	DIN EN ISO 15610
ISO 15611	siehe	DIN EN ISO 15611
ISO 15612	siehe	DIN EN ISO 15612
ISO 15613	siehe	DIN EN ISO 15613
ISO 15614-1	siehe	DIN EN ISO 15614-1

Änderungen

Gegenüber DIN EN ISO 13628-6:2008-01 wurden folgende Änderungen vorgenommen:

a) Aktualisierung der Normativen Verweisungen;

b) Erweiterung der Begriffdefinitionen u. a. zu „Pressure definitions“;

c) Neue Bilder u. a. Bild 1: „Typical Subsea control System Elements“, und Bild A.1 „Looped and Un-looped Hydraulic Circuits“;

d) Neuer normativer Anhang E „Analogue Devices, Level 1“;

e) Neuer normativer Anhang F „Digital Serial Devices, Level 2“;

f) Neuer normativer Anhang G „Intelligent Well Devices, IWIS“;

g) Neuer normativer Anhang H „Ethernet TCP/IP Devices, Level 3“;

h) Neuer informativer Anhang I „Insulation Resistance (IR)-testing“;

i) Aktualisierung des Literaturverzeichnisses.

AVA Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

Nationaler Anhang NA
(informativ)

Begriffe, Symbole und Abkürzungen

Die Benennung der folgenden Begriffe, Symbole und Abkürzungen sind identisch mit der Benennung in der englischen Fassung.

3 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1
Ladedruck
Druck, der auf der Federrückzugs-Seite eines Unterwasser-Antriebs aufrechterhalten wird, um die Schließzeitreaktion zu verbessern

3.2
geschlossener Hydraulikkreislauf
Hydraulikkreislauf(system), bei dem das gebrauchte Steuerfluid über eine Versorgungs-Rücklaufleitung an die Hydraulikdruckeinheit (HPU) zurückgeführt wird

3.3
Ventilschluss auf Befehl
Schließen des Unterwasser-Sicherheitsventils und möglicherweise weiterer Ventile in Abhängigkeit von der Konstruktion des Steuersystems

ANMERKUNG Derartige Befehle können von Hand, selbsttätig oder als Teil eines ESD-Ventils gegeben werden.

3.4
Informationsverteilungsnetzwerk
CDU
(en: communication distribution unit)
kommuniziert mit der Leiteinrichtung und verteilt Informationen innerhalb des Unterwasser-Netzwerks in einem elektrohydraulischen oder elektrischen System

3.5
Regelstrecke
Gesamtstrecke, die ein (z. B. elektrisches, optisches, hydraulisches) Steuersignal vom über Wasser befindlichen Steuersystem bis zum Unterwasser-Steuermodul oder Stellantrieb zurücklegt

3.6
Auslegungslebensdauer
festgelegte Funktionsdauer des Systems nach der Prüfung vor der Auslieferung

3.7
Auslegungsdruck
Höchstdruck, für den das System oder Bauteil bei laufender Nutzung ausgelegt ist

3.8
Diagnosedaten
Daten, die zur Überwachung des Zustands der Ausrüstung geliefert werden

ANMERKUNG Das kann die Fähigkeit einschließen, (technische) Anpassungen vorzunehmen.

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

3.9
direkte Hydraulikssteuerung
Steuerungsverfahren, bei dem eine Versorgungsleitung mit hydraulischem Druck beaufschlagt wird, so dass dieser direkt auf einen Unterwasser-Stellantrieb wirkt

ANMERKUNG Bei der Druckentlastung an der Oberfläche wird das Steuerfluid aufgrund der Funktion der Rückstellfeder im Stellantrieb über eine Versorgungsleitung an die Oberfläche zurückgeführt. Unterwasser-Funktionen können miteinander gekuppelt werden, um die Anzahl der Versorgungsleitungen zu verringern.

3.10
nachgelagert
in der Strömungsrichtung von einem Bauteil weg

3.11
elektrohydraulische Steuerung
Steuerungsverfahren, bei dem Kommunikationssignale zu dem Unterwasser-System geleitet und dazu verwendet werden, elektrisch gesteuerte hydraulische Steuerventile zu öffnen oder zu schließen. Siehe Anhang A

3.12
elektrische Steuerung
Steuerungsverfahren, bei dem Kommunikationssignale und Strom zu dem Unterwasser-System geleitet werden und Motoren verwendet werden, um Unterwasser-Ventile zu öffnen oder zu schließen. Siehe Anhang A

3.13
Experten-Betrieb
Betrieb des intelligenten Bohrlochsteuersystems (IWCS) mit anderen als den für den üblichen Betrieb verwendeten Steuerbefehlen oder Verfahren

ANMERKUNG Wird üblicherweise vom IWCS-Lieferanten oder weiteren sachkundigen Quellen verwendet, um die Diagnosedaten des IWCS zu lesen und (technische) Anpassungen an der IWCS-Ausrüstung vorzunehmen.

3.14
fliegende Zuleitung
Ein- oder Mehrleitungsverbundkabel aus Hydraulik-, Chemikalien-, elektrischen Stromkabeln sowie signaltragenden Kabeln elektrischer und/oder optischer Signale, das dazu verwendet wird, verschiedene Unterwasser-Ausrüstungen untereinander zu verbinden

ANMERKUNG Fliegende Zuleitungen können für den Einsatz mit Unterstützung durch fernbedienbare Unterwasserfahrzeuge (ROV) oder fernbedienbare Werkzeuge (ROT) ausgelegt sein.

3.15
Hydraulikkreislauf
Anordnung miteinander verbundener Bauteile, die hydraulische Energie erzeugt, überträgt, steuert und umwandelt

3.16
Hydraulikbauteil
einzelnes Bauelement, mit Ausnahme der Verrohrung, das aus einem oder mehreren Teilen besteht und dafür ausgelegt ist, ein Funktionsteil eines Hydraulikkreislaufes zu sein

3.17
hydrostatischer Prüfdruck
maximaler Prüfdruck, ein Niveau höher als der Auslegungsdruck

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

3.18
intelligentes Bohrloch
Bohrloch, das dauerhaft eingebaute Bohrlochsensoren und/oder dauerhaft eingebaute Bohrloch-Steuervorrichtungen anwendet, die von einer Anlage an der Oberfläche aus bedient werden können

3.19
intelligentes Bohrloch-Steuersystem
Steuersystem, das zum Betreiben eines intelligenten Bohrlochs verwendet wird

3.20
hydraulischer Schleifenkreislauf
Hydraulikkreislauf, bei dem die Rücklaufseite des Unterwasser-Steuermoduls (SCM) mit der Rücklauf-/Ladedruckseite der Prozessventil-Stellantriebe verbunden ist

ANMERKUNG Während des Hubs wird bei offenen Hydraulikkreisläufen das gebrauchte Steuerfluid nach außen ins Meer, oder bei geschlossenen Hydraulikkreisläufen in die Versorgungs-Rücklaufleitung ausgestoßen. Beim Rückhub wird das Steuerfluid in einer Schleife von der Stellantriebsfunktionsseite über das Wegeventil (DCV) zur Rücklauf-/Ladedruckseite des Stellantriebs geführt.

3.21
üblicher Betrieb
Betrieb des Systems zur Ausführung der vorgesehenen grundsätzlichen Funktionsweise

3.22
Offset
horizontales Element mit der Länge der Regelstrecke

3.23
offener Hydraulikkreislauf
Hydraulikkreislauf(system), bei dem das gebrauchte Steuerfluid am Unterwasser-Standort nach außen ins Meer abgeführt wird

3.24
Reaktionszeit
Summe aus der Signalzeit und der Schaltzeit

3.25
Einbauwerkzeug
Werkzeug zum Einbauen, Betreiben, Rückholen, Positionieren oder Anschließen von Unterwasser-Ausrüstungen, das von der Oberfläche aus fernbetätigt wird

ANMERKUNG Ein Beispiel dafür ist das Unterwasser-Steuermodul-Einbauwerkzeug.

3.26
Schaltzeit
Zeitdauer, die von der Ankunft eines Steuersignals am Unterwasser-Einsatzort (dem Ende der Signalzeit) bis zum Abschluss der Durchführung der Steuerfunktion vergeht

ANMERKUNG Von größtem Interesse ist dabei die Zeit, die bei einem Unterwasser-Eruptionskreuz bis zum vollständigen Hub eines Haupt- oder Seitenschiebers vergeht, der als Unterwasser-Sicherheitsventil bestimmt wurde.

3.27
Signalzeit
Zeitdauer, die zwischen der ferngesteuerten Aktivierung eines Steuerbefehls und der Aktivierung der Durchführung einer Steuerfunktion unter Wasser (Beginn der Schaltzeit) vergeht

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

3.28
Unterwasser-Produktionssteuersystem
Steuersystem, das ein Unterwasser-Produktionssystem während der Fördertätigkeiten betreibt

3.29
Oberflächen-Sicherheitsventil
Sicherheitsvorrichtung, die in der Förderbohrung des Bohrloch-Steigrohrs oberhalb des Bohrlochkopfes (Plattformbohrung) oder am Verladepunkt der Unterwasser-Bohrlochproduktion auf einer Plattform angeordnet ist, und die bei Verlust von hydraulischem Druck selbsttätig schließt

3.30
oberflächengesteuertes Unterwassersicherheitsventil
Sicherheitsvorrichtung, die in der Förderbohrung des Bohrloch-Steigrohrs unterhalb des Unterwasser-Bohrlochkopfes angeordnet ist und bei Verlust von hydraulischem Druck selbsttätig schließt

3.31
Versorgungsleitung
Kombination elektrischer Leitungen, Schlauchleitungen oder Stahlrohre entweder jeweils untereinander oder in Kombination miteinander (oder mit Glasfaserkabeln), die zum Zwecke der Flexibilität miteinander verkabelt sind und zum Zwecke der mechanischen Festigkeit ummantelt und/oder armiert sind und üblicherweise elektrischen Strom und Hydraulik, Daten und Chemikalien an ein Unterwasser-System liefern

3.32
Unterwasser-Sicherheitsventil
Sicherheitsventilanordnung, die zum Unterwasser-Sicherheitsventil (USV) erklärt wurde und die bei Stromverlust an diesem Stellantrieb selbsttätig schließt

3.33
Hydraulikkreislauf ohne Schleife
Hydraulikkreislauf, bei dem die Rücklaufseite des Stellantriebs und die Rücklaufseite des Unterwasser-Steuermoduls (SCM) nicht miteinander verbunden sind. Das Steuerfluid wird nicht in einer Schleife von einer Seite des Stellantriebs zur anderen Seite geführt.

3.34
vorgelagert
entgegen der Strömungsrichtung von einem Bauteil weg

AVA Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

Druckdefinitionen

OFFIZIELLER BEGRIFF	HÄUFIG VERWENDETE ALTERNATIVE BEGRIFFE	3.1.1	DEFINITION	
			BAUTEILBEZOGEN	SYSTEMBEZOGEN
AUSLEGUNGS-DRUCK	NENNBETRIEBS-DRUCK	DP	Allgemeine Eigenschaft eines Bauteils. Von dem Bauteil wird erwartet, dass es für eine bestimmte Auslegungslebens-dauer und/oder eine Anzahl von Zyklen bei dem Auslegungsdruck bei laufender Nutzung gewöhnlich funktioniert.	Höchstdruck, für den das System ausgelegt ist zu arbeiten. Der Auslegungsdruck des Systems wird durch das Bauteil mit dem niedrigsten Auslegungsdruck beschränkt. Das ist der maximale Sollwert für das Druckentlastungs-ventil.
HYDROSTATISCHER PRÜFDRUCK	PRÜFDRUCK	HTP	Konstanter Druck, der um einen bestimmten Faktor höher als der Auslegungsdruck ist, und mit dem ein Bauteil für eine begrenzte Dauer beaufschlagt wird, um des-sen Unversehrtheit nachzuweisen, ohne dass es zerstört wird. Das Bauteil ist nicht dafür ausgelegt, bei dem hydrostatischen Prüfdruck betrieben zu werden.	Konstanter Druck, der um einen bestimmten Faktor höher als der Auslegungsdruck ist, und mit dem ein System für eine begrenzte Dauer beaufschlagt wird, um des-sen Unversehrtheit nachzuwei-sen, ohne dass es zerstört wird. Das System ist nicht dafür ausge-legt, bei dem hydrostatischen Prüfdruck betrieben zu werden.
MAXIMALER ARBEITSDRUCK	MAXIMALER BETRIEBSDRUCK	MAX WP	Eigenschaft des Betriebssystems. Höchster Druck, bei dem das Bau-teil im Beharrungszustand arbei-ten können soll. Er muss gleich oder kleiner sein als der Ausle-gungsdruck.	Eigenschaft des Betriebssystems. Höchster Druck, bei dem das System im Beharrungszustand arbeiten können soll.
MINDESTARBEITS-DRUCK	MINDESTBETRIEBS DRUCK	MIN WP	Eigenschaft des Betriebssystems. Niedrigster Druck, bei dem das Bauteil im Beharrungszustand arbeiten können soll. Es muss ein Sicherheitsspielraum zwischen Mindestarbeitsdruck, Schließdruck des Stellantriebs und Ausrast-druck des Wegeventils (DCV) berücksichtigt werden.	Eigenschaft des Betriebssystems. Niedrigster Druck, bei dem das System im Beharrungszustand arbeiten können soll. Der System-druck muss gleich oder größer als der Mindestarbeitsdruck sein, um einen unbeabsichtigten Wechsel des Befehlszustands des DCV oder eines Stellantriebs zu ver-meiden.
LÖSEDRUCK DES WEGEVENTILS (DCV)	ABFALLDRUCK		Druck, bei dem ein DCV sich bei einem Druckabfall vom üblichen Betriebsdruck auf den Umge-bungsdruck aus der eingerasteten offenen Stellung in die störungs-sichere geschlossene (federbe-lastete) Stellung bewegt.	nicht anwendbar
BEMESSUNGS-UMGEBUNGSDRUCK			Allgemeine Eigenschaft eines Bauteils. Maximaler Umgebungs-druck (der durch die Wassersäule erzeugt wird), für den das Bauteil ausgelegt ist, dauerhaft zu arbei-ten.	Maximaler Umgebungsdruck (der durch die Wassersäule erzeugt wird), für den das System ausge-legt ist, dauerhaft zu arbeiten. Der Bemessungs-Umgebungsdruck des Systems wird durch das Bau-teil mit dem niedrigsten Bemes-sungs-Umgebungsdruck innerhalb des Systems beschränkt.
VERRIEGELUNGS-DRUCK			nicht anwendbar	Druck, bei dem das MCS alle wei-teren Arbeitsgänge des DCV sperrt, um einen kritischen Druck-abfall unter den Mindestarbeits-druck zu vermeiden.

AVA Documents Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

Definition des 3-Phasen-Systems nach der IEC-Terminologie

BEGRIFF	HÄUFIG VERWENDETE ALTERNATIVE BEGRIFFE	4	DEFINITION	
			BAUTEILBEZOGEN	SYSTEMBEZOGEN
Effektivwert der Wechselspannung AC $_{rms}$	Nennspannung	$U_0 U$ (U_m)	Allgemeine Eigenschaft einer elektrischen Leitung. Von der Leitung wird erwartet, dass sie für eine bestimmte Auslegungslebensdauer bei laufendem Wechselspannungsbetrieb gewöhnlich funktioniert.	Maximale Spannung, für die die Leitung ausgelegt ist zu arbeiten. U_0 ist die Spannung zwischen einer Leitung und einem allgemeinen Bezugswert (Erde), U ist die Leiter-Leiter-Spannung und (U_m) ist die höchste Systemspannung, bei der die elektrische Leitung verwendet werden darf.
Gleichspannung DC	Nennspannung	U_0	Allgemeine Eigenschaft einer elektrischen Leitung. Von der Leitung wird erwartet, dass sie für eine bestimmte Auslegungslebensdauer bei laufendem Gleichspannungsbetrieb gewöhnlich funktioniert.	Maximale Spannung, für die die Leitung ausgelegt ist zu arbeiten. U_0 ist die Spannung zwischen einer Leitung und einem allgemeinen Bezugswert (Erde)

4 Abkürzungen

β	Filtrationsverhältnis nach ISO 16889 und Bestimmung der Filterleistung eines Filterelementes
ANSI	Amerikanisches Normungsinstitut (en: American National Standards Institute)
API	Amerikanisches Erdölinstitut (en: American Petroleum Institute)
AS	Norm der Luft- und Raumfahrt (en: Aerospace Standard)
ASME	Berufsverband der Maschinenbauingenieure in den USA (en: American Society of Mechanical Engineers)
ASTM	Amerikanische Gesellschaft für Prüfung und Werkstoffe (en: American Society for Testing and Materials)
AWS	Amerikanische Gesellschaft für Schweißtechnik (en: American Welding Society)
capex	Kapitalkosten (en: capital expenditure)
CAT-5	ANSI/TIA/EIA-568-B-Leitungen
CAT-6	ANSI/TIA/EIA-568-B.2-1-Leitungen
CiA	CAN in der Automatisierungstechnik (en: CAN in Automation)
CIU	Anlage zur Chemikalieneinspritzung (en: chemical injection unit)
CIV	Chemikalien-Einspritzventil (en: chemical injection valve)
DC	Gleichspannung (en: direct current)
DCS	Leitsystem (en: distributed control system)
DCV	Wegeventil (en: directional control valve)
DH	direkte Hydauliksteuerung (en: direct hydraulic)
EPU	elektrische Energieversorgungseinheit (en: electrical power unit)
EM	Elektromagnetisch (en: electromagnetic)
EMC	elektromagnetische Verträglichkeit (en: electromagnetic compatibility)
ESD	Not-Aus (en: emergency shutdown)

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

ESS	Messung von Umwelteinflüssen (en: environmental stress screening)
ETH	Ethernet
EUT	zu prüfende Ausrüstung (en: equipment under test)
EXT	Erweitert (en: extended)
FAT	Werksabnahme (en: factory acceptance test)
GND	Erde (en: ground)
HIPPS	Hochleistungs-Überdruckschutzsystem (en: high integrity pressure protection system)
HP	hoher Druck (en: high pressure)
HPU	Hydraulikeinheit (en: hydraulic power unit)
HPHT	Anwendung mit hohem Druck und hoher Temperatur (en: high pressure high temp application)
ICSS	Integriertes Steuer- und Sicherheitssystem (en: integrated control and safety system)
IEC	Internationale Elektrotechnische Kommission (en: International Electrotechnical Commission)
I/O	Eingang/Ausgang (en: input/output)
IP	Internet-Protokoll (en: Internet Protocol)
ISD	intelligentes Gerät für den Einsatz am Meeresboden (en: intelligent seabed device)
ISAS	Anwendungssystem für ein ISD von der Oberfläche aus (System zur Erfassung und/oder Steuerung eines ISD) (en: ISD surface application system)
iSEM	intelligentes Unterwasser-Elektronikmodul für den Bohrlocheinsatz (en: intelligent well subsea electronics module)
ISO	Internationale Organisation für Normung (en: International Standards Organization)
IWCS	intelligentes Bohrloch-Steuersystem (en: intelligent well control system)
IWE	intelligente Bohrlochausrüstung (en: intelligent well equipment)
LP	Niederdruck (en: low pressure)
MAC	Medienzugriffssteuerung (en: media access control)
MCS	Haupt-Überwachungs-Station (en: master control station)
MIL-STD	Militärnorm (en: military standard)
OPC	Objektverknüpfung und -einbettung (OLE) für die Prozesssteuerung (en: object linking and embedding (OLE) for process control)
OPEX	Betriebskosten (en: operational expenditure)
OREDA	Offshore-Zuverlässigkeitsdaten (en: offshore reliability data)
OSI	offenes Kommunikationssystem (en: open system interconnection)
PH	vorgesteuerte Hydraulik (en: piloted hydraulic)
PMV	Produktions-Hauptventil (en: production master valve)
PPP	Punkt-zu-Punkt-Protokoll (en: point-to-point protocol)
PSD	Prozessabschaltung (en: process shutdown)
PTFE	Polytetrafluorethylen
PWV	Produktions-Seitenventil (en: production wing valve)
RET	Rücklauf (en: return)
ROT	fernbedienbares Werkzeug (en: remotely operated tool)

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

ROV	fernbedienbares Fahrzeug (en: remotely operated vehicle)
RX	Funkempfänger (en: radio receiver)
SCM	Unterwasser-Steuermodul (en: subsea control module)
SCSSV	oberflächengesteuertes Unterwasser-Sicherheitsventil (en: surface-controlled subsurface safety valve)
SDU	Unterwasser-Verteilungseinheit (en: subsea distribution unit)
SPCS	Unterwasser-Produktionssteuersystem (en: subsea production control system)
SPS	Unterwasser-Fördersystem (en: subsea production system)
TCP	Übertragungssteuerungsprotokoll (en: transmission control protocol)
TX	Funksender (en: radio transmitter)
UDP	User Datagram Protocol (en: user datagram protocol)
UPS	unterbrechungsfreie Stromversorgung (en: uninterruptible power supply)
USV	Unterwasser-Sicherheitsventil – üblicherweise das PMV und/oder PWV (en: underwater safety valve – typically the PMV and/or PWV)
VDC	Volt (Gleichspannung) (en: volts direct current)

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

Nationaler Anhang NB
(informativ)

Literaturhinweise

DIN EN 287-1, *Prüfung von Schweißern — Schmelzschweißen — Teil 1: Stähle*

DIN EN ISO 9606-2, *Prüfung von Schweißern — Schmelzschweißen — Teil 2: Aluminium und Aluminiumlegierungen*

DIN EN ISO 10423, *Erdöl- und Erdgasindustrie — Bohr- und Förderausrüstung — Bohrlochkopf- und Eruptionskreuz-Ausrüstung*

DIN EN ISO 15607, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Allgemeine Regeln*

DIN EN ISO 15609-2, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Schweißanweisung — Teil 2: Gasschweißen*

DIN EN ISO 15610, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Qualifizierung aufgrund des Einsatzes von geprüften Schweißzusätzen*

DIN EN ISO 15611, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Qualifizierung aufgrund von vorliegender schweißtechnischer Erfahrung*

DIN EN ISO 15612, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Qualifizierung durch Einsatz eines Standardschweißverfahrens*

DIN EN ISO 15613, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Qualifizierung aufgrund einer vorgezogenen Arbeitsprüfung*

DIN EN ISO 15614-1, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Schweißverfahrensprüfung — Teil 1: Lichtbogen- und Gasschweißen von Stählen und Lichtbogenschweißen von Nickel und Nickellegierungen*

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

— Entwurf —

CEN/TC 12

Date: 2012-01

prEN ISO 13628-6:2012

CEN/TC 12

Secretariat: AFNOR

Petroleum and natural gas industries — Design and operation of subsea production systems — Part 6: Subsea production control systems (ISO/DIS 13628-6:2011)

Erdöl- und Erdgasindustrie — Auslegung und Betrieb von Unterwasser-Produktionssystemen — Teil 6: Steuersysteme für die Unterwasser-Produktion (ISO/DIS 13628-6:2011)

Industries du pétrole et du gaz naturel — Conception et exploitation des systèmes de production immergés — Partie 6 : Commandes pour équipements immergés (ISO/DIS 13628-6:2011)

ICS:

Descriptors:

Document type: European Standard
Document subtype:
Document stage: CEN Enquiry
Document language: E

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

Contents

Page

Foreword 3
1 **Scope** 4
2 **Normative references** 4
3 **Terms and definitions** 6
4 **Symbols and abbreviated terms** 10
5 **System requirements** 11
6 **Surface equipment** 35
7 **Subsea equipment** 44
8 **Interfaces** 57
9 **Materials and fabrication** 60
10 **Testing** 62
11 **Marking, packaging, storage and shipping** 74
Annex A (informative) **Types and selection of control system** 77
Annex B (informative) **Typical control and monitoring functions** 82
Annex C (informative) **Property requirements of control fluids** 85
Annex D (informative) **Operational considerations with respect to flowline pressure exposure** 112
Annex E (informative) **Analogue devices, level 1** 114
Annex F (normative) **Digital serial devices, level 2** 115
Annex G (normative) **Intelligent well devices, IWIS** 121
Annex H (normative) **Ethernet TCP/IP devices, level 3** 132
Annex I (normative) **Insulation resistance (IR) testing** 140
Bibliography 141

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

Foreword

The text of ISO/DIS 13628-6:2011 has been prepared by Technical Committee ISO/TC 67 “Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries Title” of the International Organization for Standardization (ISO) and has been taken over as prEN ISO 13628-6:2012 by Technical Committee CEN/TC 12 “Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries” the secretariat of which is held by AFNOR.

This document is currently submitted to the parallel Enquiry.

This document will supersede EN ISO 13628 6:2006.

Endorsement notice

The text of ISO/DIS 13628-6:2011 has been approved by CEN as a prEN ISO 13628-6:2012 without any modification.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

1 Scope

This part of ISO 13628 is applicable to design, fabrication, testing, installation and operation of subsea production control systems.

This part of ISO 13628 covers surface control system equipment, subsea-installed control system equipment and control fluids. This equipment is utilized for control of subsea production of oil and gas and for subsea water and gas injection services. Where applicable, this part of ISO 13628 can be used for equipment on multiple-well applications.

Rework and repair of used equipment are beyond the scope of this part of ISO 13628.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3722, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods*

ISO 4406:1999, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 4407, *Hydraulic fluid power — Fluid contamination – Determination of particulate contamination by the counting method using an optical microscope*

ISO 7498 (all parts), *Information processing systems — Open Systems Interconnection — Basic Reference Model*

ISO/IEC 8802-3, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO 9606-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

ISO 9606-2, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys*

ISO 10423, *Petroleum and natural gas industries — Drilling and production equipment — Wellhead and christmas tree equipment*

ISO 10945, Hydraulic fluid power — Gas-loaded accumulators — Dimensions of gas ports

ISO/TR 10949, *Hydraulic fluid power — Component cleanliness — Guidelines for achieving and controlling cleanliness of components from manufacture to installation*

ISO 11500, *Hydraulic fluid power -- Determination of the particulate contamination level of a liquid sample by automatic particle counting using the light-extinction principle*

ISO 11898-3, *Road Vehicles – Controller Area Network (CAN) – Part 3: Low-Speed, Fault-Tolerant, Medium-Dependent Interface*

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15609-2, *Specification and qualification of welding procedures for metallic materials —Welding procedure specification — Part 2: Gas welding*

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

ISO 15610, *Specification and qualification of welding procedures for metallic materials — Qualification based on tested welding consumables*

ISO 15611, *Specification and qualification of welding procedures for metallic materials — Qualification based on previous welding experience*

ISO 15612, *Specification and qualification of welding procedures for metallic materials — Qualification by adoption of a standard welding procedure*

ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials —Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 16889, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element*

ISO 21018,*Hydraulic fluid power —Monitoring the level of particulate contamination of the fluid — Part 1: General principles*

ANSI/ASME B31.3, *Process Piping*

ANSI/TIA/EIA-568-B, *Commercial Building Telecommunications Cabling Standard*

AS 4059, *Aerospace fluid power — Cleanliness classification for hydraulic fluids*

ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for the Construction of Pressure Vessels*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding and Brazing Qualifications*

ASME Boiler and Pressure Vessel Code, Section V,*Non-destructive Examination*

ASTM D97, *Standard Method for Pour Point of Petroleum Products*

ASTM D445, *Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)*

ASTM D1141, *Standard Practice for the Preparation of Substitute Ocean Water*

ASTM D1401,*Water Separability of Petroleum Oils and Synthetic Fluids*

ASTM D3233, *Standard Test Methods for Measurement of Extreme Pressure Properties of Fluid Lubricants (Falex Pin and Vee Block Methods)*

ASTM G1:2003, *Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens*

BS 7201-1, *Hydraulic fluid power — Gas loaded accumulators — Specification for seamless steel accumulator bodies above 0,5 l water capacity*

CiA 309-1, *Interfacing CANopen with TCP/IP – Part 1: General Principles and Services*

CiA 309-3, *Interfacing CANopen with TCP/IP – Part 3: ASCII Mapping*

CiA 443, *CANopen Profile for SIIS Level-2 Devices*

DIN 41612-2, *Special contacts for multi two-part connectors; concentric contacts (type C)*

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

IEEE 802.3, *CSMA/CD Ethernet*

Internet RFC 791, *Internet Protocol, http://www.faqs.org/rfcs/rfc791.html*

Internet RFC 793, *The Transmission Control Protocol (TCP), http://www.faqs.org/rfcs/rfc793.html*

Internet RFC 1332, *The PPP Internet Protocol Control Protocol (IPCP), http://www.ietf.org/rfc/rfc1332.txt*

Internet RFC 1661, *The Point-to-Point Protocol (PPP), http://www.faqs.org/rfcs/rfc1661.html*

Internet RFC 768, *User Datagram Protocol*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
boost
pressure maintained on the spring-return side of a subsea actuator for the purposes of improving closing-time response

3.2
closed hydraulic circuit
hydraulic circuit (system) where the used control fluid is returned to the HPU through an umbilical return line

3.3
commanded closure
closure of the underwater safety valve and possibly other valves depending on the control system design

NOTE Such commands can originate manually, automatically or as part of an ESD.

3.4
communication distribution unit
CDU
communicates with the host facility and distributes communication within the subsea network in an electrohydraulic or electric system

3.5
control path
total distance that a control signal (e.g. electrical, optical, hydraulic) travels from the topside control system to the subsea control module or valve actuator

3.6
design life
specified operational life of system after pre-delivery test

3.7
design pressure
maximum pressure for which the system or component was designed for continuous usage

3.8
diagnostic data
data provided to monitor the condition of the equipment

NOTE Can include the ability to make (engineering) adjustments.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

3.9
direct hydraulic control
control method wherein hydraulic pressure is applied through an umbilical line to act directly on a subsea valve actuator

NOTE Upon venting of the pressure at the surface, the control fluid is returned through the umbilical to the surface due to the action of the restoring spring in the valve actuator. Subsea functions may be ganged together to reduce the number of umbilical lines.

3.10
downstream
away from a component in the direction of flow

3.11
electrohydraulic control
control method wherein communication signals are conducted to the subsea system and used to open or close electrically-controlled hydraulic control valves. See Annex A.

3.12
electric control
control method wherein communication signals and power are conducted to the subsea system and use motors to open or close Subsea valves. See Annex A.

3.13
expert operation
operating the IWCS with other control commands or other methods than used for normal operation

NOTE Typically used by IWCS supplier or other skilled resource to read IWCS diagnostic data and make (engineering) adjustments to IWCS equipment.

3.14
flying lead
single or multiple composite grouping of hydraulic, chemical, electrical power, electrical signal, and/or optical signal carrying conduits used to interconnect various items of subsea equipment.

NOTE Flying leads may be designed for ROV or ROT assisted deployment.

3.15
hydraulic circuit
arrangement of interconnected components which generates, transmits, controls and converts hydraulic energy

3.16
hydraulic component
individual unit, excluding piping, comprising one or more parts designed to be a functional part of a hydraulic circuit

3.17
hydrostatic test pressure
maximum test pressure at a level greater than the design pressure

3.18
intelligent well
well that employs permanently installed downhole sensors and/or permanently installed downhole control devices that are operable from a surface facility

3.19
intelligent well control system
control system used to operate an intelligent well

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

3.20
looped hydraulic circuit
hydraulic circuit where the return side of the SCM is connected to the return/boost side of the process valve actuators

NOTE During stroking, used control fluid is expelled to ambient sea for open hydraulic circuits, or into the umbilical return line for closed hydraulic circuits. At the return stroke, control fluid from the actuator function side is looped via the DCV to the actuator return/boost side.

3.21
normal operation
operating the system to perform the intended basic functionality

3.22
offset
horizontal component of control path length

3.23
open hydraulic circuit
hydraulic circuit (system) where the used control fluid is exhausted into the ambient sea at the subsea location.

3.24
response time
sum of the signal time and the shift time

3.25
running tool
tool used to install, operate, retrieve, position or connect subsea equipment remotely from the surface

NOTE An example is the subsea control-module running tool.

3.26
shift time
period of time elapsed between the arrival of a control signal at the subsea location (the completion of the signal time) and the completion of the control function operation

NOTE Of primary interest is the time to fully stroke, on a subsea tree, a master or wing valve that has been designated as the underwater safety valve.

3.27
signal time
period of time elapsed between the remote initiation of a control command and the initiation of a control function operation subsea (the commencement of the shift time)

3.28
subsea production control system
control system operating a subsea production system during production operations

3.29
surface safety valve
safety device that is located in the production bore of the well tubing above the wellhead (platform well), or at the point of subsea well production embarkation onto a platform, and that will automatically close upon loss of hydraulic pressure

3.30
surface controlled subsurface safety valve
safety device that is located in the production bore of the well tubing below the subsea wellhead and that will close on loss of hydraulic pressure

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

3.31
umbilical
combination of electric cables, hoses or steel tubes, either on their own or in combination (or with fibre optic cables), cabled together for flexibility and over-sheathed and/or armoured for mechanical strength and typically supplying power and hydraulics, communication and chemicals to a subsea system

3.32
underwater safety valve
safety valve assembly that is declared to be the USV and which will automatically close upon loss of power to that actuator

3.33
unlooped hydraulic circuit
hydraulic circuit where the actuator return side and the SCM return side are not interconnected. Control fluid is not looped from either side of the actuator to the other side

3.34
upstream
away from a component against the direction of flow

Pressure definitions

OFFICIAL TERM	WIDELY USED ALTERNATIVE TERMS	3.1.1	DEFINITION	
			COMPONENT BASED	SYSTEM BASED
DESIGN PRESSURE	RATED WORKING PRESSURE	DP	A generic component characteristic. The component is expected to function normally for a given design life and/or a number of cycles at the design pressure in continuous usage.	The maximum pressure for which the system is designed to operate. The system design pressure is limited by the component with the lowest design pressure. This is the maximum set point for the pressure relief valve.
HYDROSTATIC TEST PRESSURE	PROOF PRESSURE; TEST PRESSURE	HTP	Constant pressure, at a defined factor higher than the design pressure applied to a component for a limited duration to demonstrate its integrity without causing destruction or deterioration. The component is not designed to be operated at the hydrostatic test pressure	Constant pressure, at a defined factor higher than the design pressure applied to a system for a limited duration to demonstrate its integrity without causing destruction or deterioration. The system is not designed to be operated at the hydrostatic test pressure
MAXIMUM WORKING PRESSURE	MAXIMUM OPERATING PRESSURE	MAX WP	An operational system characteristic. The highest pressure at which the component is intended to operate in steady state conditions. It shallbe equal or lower than design pressure.	An operational system characteristic. The highest pressure at which the system is intended to operate in steady state conditions.
MINIMUM WORKING PRESSURE	MINIMUM OPERATING PRESSURE	MIN WP	An operational system characteristic. The lowest pressure at which the component is intended to operate in steady state conditions. A safety margin between minimum working pressure, actuator closing pressure and DCV delatching pressure shallbe considered.	An operational system characteristic. The lowest pressure at which the system is intended to operate in steady state conditions. System pressure shallbe equal or above minimum working pressure to avoid unintended change of commanded state of any DCV or actuator.
DCV DELATCHING PRESSURE	DROP-OUT PRESSURE		On falling pressure from normal working pressure towards ambient pressure the pressure at which a DCV moves from the latched open position into the fail-safe close (spring loaded) position.	N/A
DESIGN AMBIENT PRESSURE			A generic component characteristic. The maximum ambient pressure (induced by hydrostatic head) for which the component is designed to operate continuously.	The maximum ambient pressure (induced by hydrostatic head) for which the system is designed to operate continuously. The system design ambient pressure is limited by the component with the lowest design ambient pressure in the system
INTERLOCK PRESSURE			N/A	Pressure at which the MCS locks any further DCV operation to avoid a critical pressure drop below the minimum working pressure.

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

Definition for 3-phase system according to IEC terminology

TERM	WIDELY USED ALTERNATIVE TERMS	4	DEFINITION	
			COMPONENT BASED	SYSTEM BASED
Voltage AC $_{rms}$	Rated voltage	U_0U (U_m)	A generic cable characteristic. The cable is expected to function normally for a given design life in continuous AC voltage usage.	The maximum voltage for which the cable is designed to operate. The U_0 is the voltage between a line and common reference (ground), U is the line to line voltage and (U_m) is the highest system voltage for which the cable may be used
Voltage DC	Rated voltage	U_0	A generic cable characteristic. The cable is expected to function normally for a given design life in continuous DC usage.	The maximum voltage for which the cable is designed to operate. The U_0 is the voltage between a line and common reference (ground)

4 Symbols and abbreviated terms

β	filtration ratio obtained in ISO 16889 and used to rate the performance of hydraulic filters
ANSI	American National Standards Institute
API	American Petroleum Institute
AS	Aerospace Standard
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CAPEX	capital expenditure
CAT-5	ANSI/TIA/EIA-568-B cables
CAT-6	ANSI/TIA/EIA-568-B.2-1 cables
CiA	CAN in automation
CIU	chemical injection unit
CIV	chemical injection valve
DC	direct current
DCS	distributed control system
DCV	directional control valve
DH	direct hydraulic
EPU	electrical power unit
EM	electromagnetic
EMC	electromagnetic compatibility
ESD	emergency shutdown
ESS	environmental stress screening
ETH	ethernet
EUT	equipment under test
EXT	extended
FAT	factory acceptance test
GND	ground
HIPPS	high integrity pressure protection system
HP	high pressure
HPU	hydraulic power unit
HPHT	high pressure high temp application
ICSS	integrated control and safety system

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

IEC	International Electrotechnical Commission
I/O	input/output
IP	Internet Protocol
ISD	intelligent seabed device
ISAS	ISD surface application system (system for acquisition and/or control of ISD)
iSEM	intelligent well subsea electronics module
ISO	International Organization for Standardization
IWCS	intelligent well control system
IWE	intelligent well equipment
LP	low pressure
MAC	media access control
MCS	master control station
MIL-STD	military standard
OPC	object linking and embedding (OLE) for process control
OPEX	operational expenditure
OREDA	offshore reliability data
OSI	open system interconnection
PH	piloted hydraulic
PMV	production master valve
PPP	point-to-point protocol
PSD	process shutdown
PTFE	polytetrafluoroethylene
PWV	production wing valve
RET	return
ROT	remotely operated tool
ROV	remotely operated vehicle
RX	radio receiver
SCM	subsea control module
SCSSV	surface-controlled subsurface safety valve
SDU	subsea distribution unit
SPCS	subsea production control system
SPS	subsea production system
TCP	transmission control protocol
TX	radio transmitter
UDP	user datagram protocol
UPS	uninterruptible power supply
USV	underwater safety valve – typically the PMV and/or PWV
VDC	volts direct current

5 System requirements

5.1 General

This clause describes the activities of specifying organisations. Figure 1 depicts the typical subsea control system elements. Reference should be made to Annex A for types and selection of control system, and to Annex B for typical control and monitoring functions.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

System designs should generally consider inherently safe systems as a basis for designs.

If novel or extrapolated technology is being used or if proven equipment is being applied in unproven or novel applications, appropriate measures to verify equipment integrity should be taken. Such measures should include rigorous application of qualification testing, which should fully explore and quantify the equipment's ultimate operational limits.

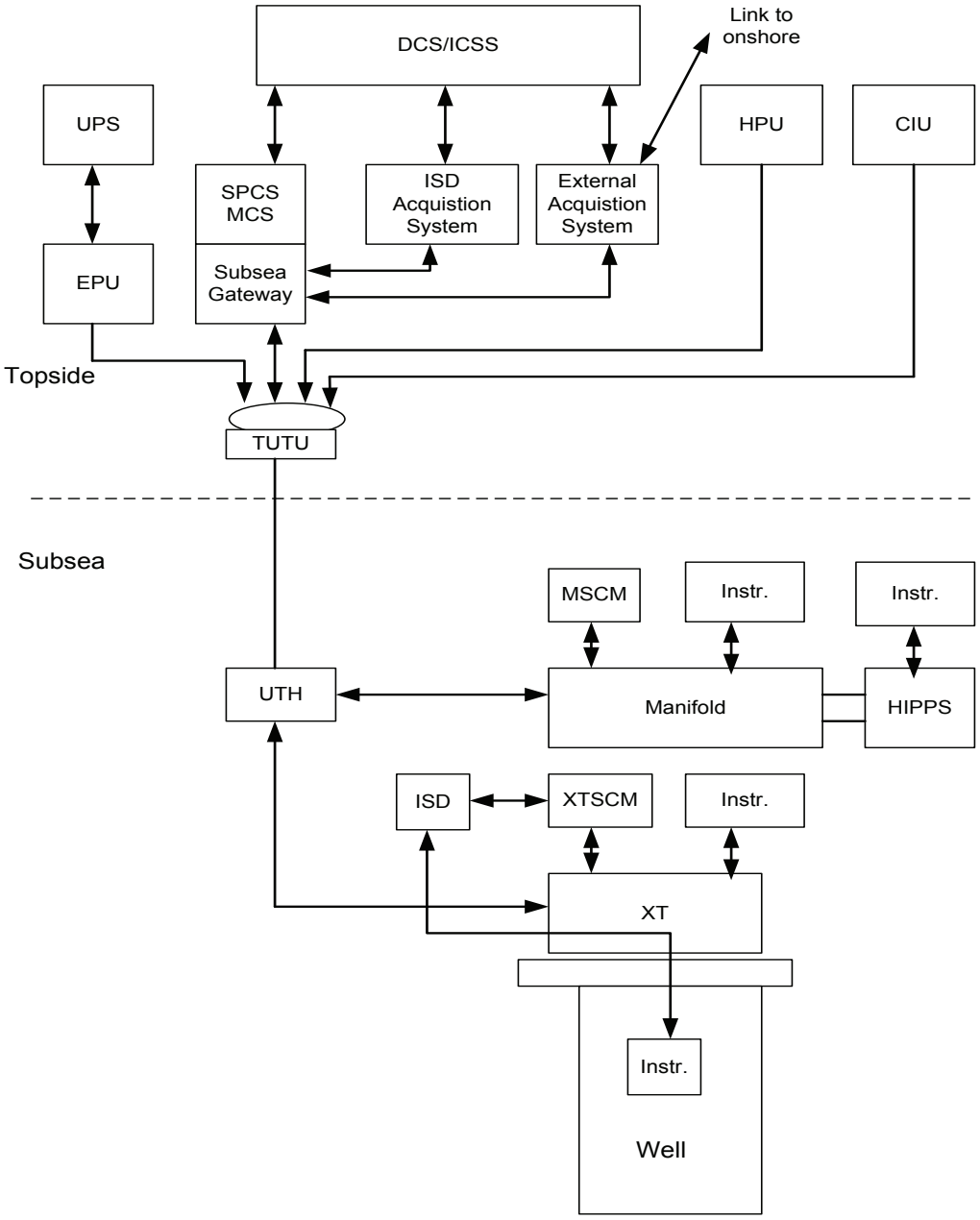


Figure 1 — Typicalsubsea control system elements

5.2 Concept development

During front-end engineering, possible impact on control system functionality and infrastructure related to the following items shall be considered:

— flexibility with respect to production scenarios;

— optimization with respect to operation;

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

— optimization with respect to cost-effective installation;

— optimization with respect to phased production development;

— flow assurance;

— project execution time;

— life cycle cost [component cost and installation cost (CAPEX), operation/maintenance/intervention cost (OPEX)].

Operational philosophy, installation sequences and possible operational challenges shall be evaluated during front-end engineering.

Reference should be made to Annex D for operational considerations with respect to flowline pressure exposure.

Reference should be made to ISO 13628-1[6] for considerations with respect to system engineering step by step approach

5.3 Production control system functionality requirement

5.3.1 General

The subsea production control system shall allow for flexibility and optimization. The basic system design shall to a maximum extent allow for a full range of functionality with use of existing infrastructure.

The following elements shall be considered during system engineering:

— horizontal integration;

— inhibition after unintended shutdown;

— intelligent well application;

— flexibility with respect to electrical load situations (power and communication);

— robustness of hydraulic system;

— prevention of seawater ingress in hydraulic system;

— seawater ingress material compatibility;

— subsea intervention;

— increased scope with respect to number of wells;

— increased scope with respect to number of umbilicals;

— increased scope with respect tocontrol/instrumentation functionality;

— interface toward subsea separation/subsea boosting systems;

— subsea chemical injection;

— downhole instrumentation system interfaces;

— downhole chemical injection.

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

5.3.2 Horizontal integration for subsea control system components

The potential for horizontal integration of equipment shall be considered during the design of the subsea control system. Horizontal integration can be defined as where common products are used for different operating scenarios. Examples of this may include the use of production control system components for workover or intervention equipment.

Through the use of horizontal integration, the project may benefit from common spare philosophies, familiarity of operation, and economies of scale.

In order to maximise the potential for horizontal integration, the specification for equipment should include standard interfaces (e.g. defined in 8.5), which will allow different sensors/actuators to be used easily between the differing modes of operation, and data made available users at the surface.

5.3.3 Inhibition after unintended shutdown

An unintended shutdown of a gas producing well or system of wells may require inhibition of the wells to prevent hydrate formation. The ability of the system to cope with such scenarios shallbe demonstrated.

5.3.4 Intelligent well application

If anintelligentwell completion is clearly defined as a current or future requirement by front-end engineering efforts, the control system will provide valve functionality, data retrieval, computational support and communication pathways without the need for changing the subsea umbilical system and the associated distribution system. Subsea control modules may be expected to be retrieved and retrofitted to accommodate the introduction of intelligent well systems at a future date.

Automatic shutdown functionality is not required for the downhole intelligent well functions.

Any project proposing implementing downhole flow control within the tree mounted SCM should perform a documented review of proposed designs with respect to potential integrity risks and potential impact on the configuration of the standard SCM design.

Hydraulically actuated tree mounted isolation valves that are installed on intelligent well hydraulic function lines shall have automatic shutdown functionality. These valves should be controlled from the tree mounted SCM. Consideration should be given to systems cool down/warm up performance.

5.3.5 Flexibility with respect to electrical load situations (power and communication)

The system should be built to function properly within a large range of electrical load variations to allow for flexibility regarding new wells. Load flexibility can help overcome electrical distribution system failures by connecting more wells to the same cable.

5.3.6 Robustness of hydraulic system

The hydraulic system shall be robust and maintain acceptable pressure values in the SCM during all modes of operation.

Actuation of valve actuators shall not cause alarms or unintended valve movement due to low supply pressure in the SCM.

Vulnerable parts with very low fluid consumption (e.g. control valve pilot stages) should be protected by dedicated filters in addition to LP or HP filters.

5.3.7 Seawater ingress in hydraulic system

The hydraulic system shall be designed to minimize seawater ingress in all operational scenarios, including installation and retrieval of individual units. If seawater ingress prevention cannot be guaranteed or if there is a

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

credible risk of seawater ingress, SCM fluid-wetted components should be considered along with procedures to flush out contaminated fluid.

All SCM functional components that can come into contact with seawater (either by design or by component failure) and, in particular, all hydraulic control fluid wetted components in the subsea production control system should be seawater tolerant.

5.3.8 Subsea intervention

The subsea control system shall be designed for cost-effective subsea intervention tasks, with respect to both ROV and diver applications.

5.3.9 Increased scope with respect to number of wells

The system shall allow for flexibility with respect to number of wells tied into the system. Operational and criticality analysis should represent the practical limitations with respect to number of wells rather than mechanical limitations.

5.3.10 Increased scope with respect to number of umbilicals

System design, when defined as a future requirement by front-end engineering, shall allow for additional umbilical systems to be connected. A philosophy covering both serial and parallel connections should be outlined.

5.3.11 Interface toward subsea separation/subsea boosting system

The system design when defined as a future requirement by front-end engineering shall allow for possible connection of a subsea separation or boosting system without extensive marine operations or modifications related to an existing system. Possible impact on production control system shall be described at an outline level during system design.

5.3.12 Subsea chemical injection

Flow-assurance issues shall be considered during front-end engineering. The system shall allow for flexibility with respect to possible chemical injection scenarios during the operational phase. This flexibility can be achieved by including spare lines in the subsea distributionsystem, plan for possible subsea chemical injection system add on, reconfiguration of lines, etc. Possible impact on production control system shall be described at an outline level during system design.

5.3.13 Downhole instrumentation system interfaces

The production control system shall allow for flexibility regarding interface toward downhole instrumentation systems. Possible impact on production control system shall be described at an outline level during system design.

5.3.14 Downhole chemical injection

The subsea production system shall, if applicable, allow for downhole chemical injection. Possible impact on production control system shall be described at an outline level during system design.

5.4 General requirements

5.4.1 General description

The functional building blocks of a subsea production control system typically include the following. These building blocks may be integrated in the same physical units:

a) hydraulic power unit (HPU);

   The HPU provides a stable and clean supply of hydraulic fluid to the remotely operated subsea valves. The fluid is supplied via the controls' umbilical, the subsea hydraulic distribution system, and the SCMs (if included in system design) to operate subsea valve actuators.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

b) chemical injection unit (CIU);

The CIU provides single and/or mixed “cocktail” chemicals at constant regulated pressure or metered volume. The fluid is supplied via the hydraulic umbilical and the subsea hydraulic distribution system to the injection points of the subsea production system.

c) master control station (MCS);

The MCS may be the central control “node” containing application software required to control and monitor the subsea production system and associated topside equipment, e.g. the HPU and EPU.

d) distributed control system (DCS);

The DCS can perform the same functions as an MCS, but with a decentralized configuration.

e) electrical power unit (EPU);

The EPU supplies electrical power at the desired voltage and frequency to the subsea users. Power transmission is performed via the electrical umbilical and the subsea electrical distribution system.

f) subsea gateway (SG);

This unit is the access point for communication to Subsea and modulates and demodulates communication signals for transmission to and from the applicable subsea users.

g) uninterruptible power supply (UPS);

The UPS is typically provided to ensure safe and reliable electrical power to the subsea production control system.

h) umbilical;

The umbilical(s) transfer(s), as required, electrical power and communication signals, hydraulic power, and/or chemicals to the subsea components of the subsea production system. Communication signals may be transmitted via power cable (signal on power), signal cable or fibre optic.

i) subsea control module (SCM);

In a piloted-hydraulic, electrohydraulic or electric control system, the SCM is the unit that, upon command from the MCS, directs hydraulic fluid to operate subsea valves. In an all electrical control system, the SCM is the unit that, upon command from the MCS, directs electrical power to operate Subsea valves. In an electrohydraulic or electric system, the SCM also gathers information from the subsea control system equipment and transmits the information to the topside facility.

j) subsea distribution systems;

Distribution systems distribute electrical, hydraulic and chemical supplies and electrical/optical communications signals from the umbilical termination(s) to the subsea trees, manifold valves, injection points, and the control modules of the subsea production control system.

k) subsea and downhole sensors;

Sensors located in the SCMs, on subsea trees or manifolds, on the seabed or downhole provide data to monitor and control operation of the subsea production system.

l) control fluids;

Liquids are used to transmit, control and distribute hydraulic signals and energy from the HPU to the subsea control system.

m) control buoy;

Moored-buoy-housing generation, communication and chemical injection (optional) equipment is connected to the subsea components of the subsea production system via an electrical/fibre

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

optic/hydraulic control umbilical. The buoy can communicate with the surface production facility via umbilical, acoustic, radio or satellite links or a combination thereof.

n) flying lead.

Flying lead(s) transfer(s) electrical power and communications signals, hydraulic power, and/or chemicals to the subsea components of the subsea production system. Signals may be transmitted via combined signal and power cable, separate signal and power cable, or separate fibre optic signal and power cable.

This part of ISO 13628 covers all systems, both hydraulic electrohydraulic and electric. Only the relevant subclauses should be used.

5.4.2 Service condition

5.4.2.1 Suitability for working environment

The subsea control system shall be designed and operated with consideration for the external environment. For surface facilities, this includes climatic conditions, corrosion, marine growth, tidal forces, illumination and hazardous-area classifications. For the subsea environment, this includes corrosion, ambient pressure and temperature, marine growth and fouling, fishing activity or marine operations, currents, seafloor composition and maintenance considerations. Suitability to the likely storage environment should be considered. This can include ultra-violet radiation, ozone, ice, sand, wind, humidity or temperature extremes.

Product designs shall be capable of withstanding design pressure at rated temperature without degradation, exceeding allowable stress levels, or impairment of other performance requirements for the design life of the system.

5.4.2.2 Temperature ratings (host facility equipment)

5.4.2.2.1 Without controlled environment

Surface-installed equipment covered by this part of ISO 13628 and not installed in a controlled environment shall be designed, tested, operated and stored in accordance with the temperature ratings listed in Table 1.

Table 1 — Temperature rating — Surface-installed equipment without controlled environment

	Electronics		System	
	°C	(°F)	°C	(°F)
Design				
a) Standard	0 to 40	(32 to 104)	0 to 40	(32 to 104)
b) Extended	– 18 to 70	(0 to 158)	– 18 to 40	(0 to 104)
Operate				
a) Standard	0 to 40	(32 to 104)	0 to 40	(32 to 104)
b) Extended	– 5 to 40	(23 to 104)	– 5 to 40	(23 to 104)
Store	– 18 to 50	(0 to 122)	– 18 to 50	(0 to 122)
Temperatures relate to environment, not individual components.				

Equipment shall be marked in accordance with 12.1.2.

5.4.2.2.2 Controlled environment

Surface-installed equipment covered by this part of ISO 13628, and installed in a controlled environment, shall be designed, tested, operated and stored in accordance with temperature ratings compatible with the specified controlled environment.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

Packaged assemblies or components that are restricted for use in a controlled environment shall be appropriately marked in accordance with the provision of 12.1.3.

5.4.2.3 Temperature ratings(subsea-installed equipment)

Subsea-installed equipment covered by this part of ISO 13628 shall be designed, tested, operated and stored in accordance with the temperature ratings listed in Table 2.

NOTE Test refers to the all pre-deployment testing environments that the equipment may be operated in e.g. EFAT, SIT, deck testing, etc.

Table 2 — Temperature rating — Subsea-installed equipment

	Electronics		System	
	°C	(°F)	°C	(°F)
Design				
a) Standard	– 10 to 70	(14 to 158)	0 to 40	(32 to 104)
b) Extended	– 18 to 70	(0 to 158)	– 18 to 40	(0 to 104)
Test				
a) Standard	– 10 to 40	(14 to 104)	0 to 40	(32 to 104)
b) Extended	– 18 to 40	(0 to 104)	– 18 to 40	(0 to 104)
Operate				
a) Standard	0 to 40	(32 to 104)	0 to 40	(32 to 104)
b) Extended	– 5 to 40	(23 to 104)	– 5 to 40	(23 to 104)
Store	– 18 to 50	(0 to 122)	– 18 to 50	(0 to 122)
The temperatures relate to environment, not individual components. Subsea sensors that monitor produced or injected fluid may operate outside the ranges given. They shall be rated accordingly.				

Equipment shall be marked in accordance with 11.1.2.

Special consideration should be given to the minimum design and operational temperature ratings of subsea control system equipment that may be exposed to significant Joules-Thompson cooling effects in service,e.g. sensors positioned immediately downstream of production chokes.

5.4.2.4 Electromagnetic compatibility

The design shall conform to the applicable local regulations regarding EMC for the environment in which the equipment is used. For EMC, surface equipment comes within the scope of IEC 61892 (all relevant parts)[55] which cites IEC 60533[22] although the IEC 61000-1, 2 and 6 series of standards, may be more appropriate.

5.4.2.5 Storage/test temperature recommendations

If subsea-installed or surface-installed equipment is to be stored or tested on the surface at a temperature outside its temperature rating, then the manufacturer should be contacted to determine if special storage or surface testing procedures are recommended. Manufacturers shall document any such special storage or surface testing considerations, e.g. exposure to fluctuations in ultra violet, ozone, ice sand, wind, humidity, or temperature extremes.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

5.4.3 Hydraulic supply system

5.4.3.1 Pressure ratings

5.4.3.1.1 General

Specialized conditions shall also be considered, such as pressure rating changes in system and component interfaces (e.g. subsea control module to mounting base, umbilical to tree-mounted terminations) and pressurizing with temporary plugs and caps installed. The effects of external loads (i.e. bending moments, tension), ambient hydrostatic loads and fatigue shall be considered.

The maximum working pressure of the system shall not exceed the design pressure of the components that form the system.

In order to preserve the existing installed base of designed, qualified and field-proven systems and equipment with a safe field-operations history, such systems and equipment should be exempted from the working design, and test pressure rating sub clauses in this part of ISO 13628, and accepted for use within projects/systems specifying compliance with this edition of this part of ISO 13628. Where applicable to the preceding, exceptions to this part of ISO 13628 shall be identified early in the development process and addressed on a case-by-case basis.

Provisions shall be made to include a system pressure relieving device, normally a system pressure relief valve at the HPU, to ensure that surge pressures in the system do not exceed the design pressure of the system components by more than 10 %. The pressure relief valve shall be set at or below the design pressure. The relief valve should not crack open at a lower pressure than the set pressure. The pressure relief valve shall however limit the surge pressure to maximum 10% above the design pressure of the hydraulic system.

When setting the system pressure-controlling device, normally a pressure regulator, a minimum 5% of the design pressure should be left as a margin between the maximum working pressure of the system (as set by the system pressure-controlling device) and the reseat pressure of the system pressure-relieving device. This is to prevent overlapping of the two pressures with excessive pump operation as a result. The margin between set pressure of the pressure-controlling device and the design pressure shall however be a function of the performance of the pressure-controlling device and the relief valve.

Components integrated into a system shall not be subjected to a system hydrostatic pressure test in excess of their component qualification or FAT hydrostatic test pressure.

5.4.3.1.2 Hydraulic control components

It is recommended that hydraulic components have design pressure classes according to Table3. Hydraulic components for the SCSSV circuit shall have a design pressure in accordance with the design pressures of the SCSSV.

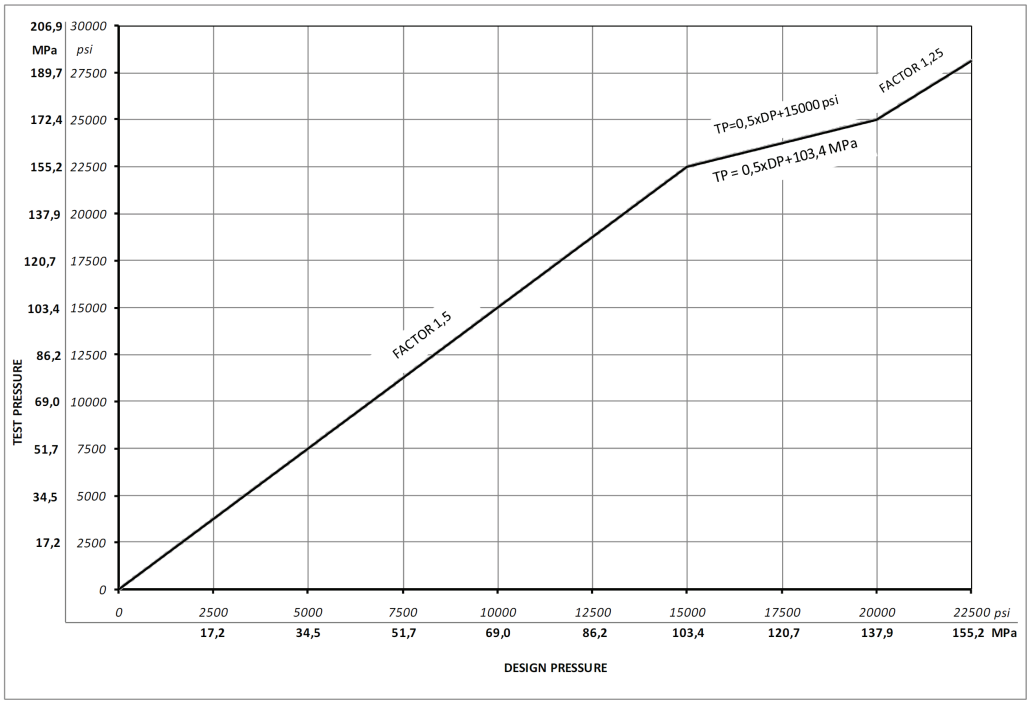
Table 3 — Pressure relations

Recommended design-pressure classes			Hydrostatic test pressure		
MPa	bar	psi	MPa	bar	psi
10,3	103	1500	15,5	155	2250
20,7	207	3000	31,1	311	4500
34,5	345	5000	51,8	518	7500
51,7	517	7500	77,6	776	11250
69,0	690	10000	103,5	1035	15000
103,5	1035	15000	155,0	1550	22500
137.9	1380	20000	172,5	1725	25000
172,4	1724	25000	215,5	2155	31250

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

INTERNAL HYDROSTATIC TEST PRESSURE CALCULATION



DP ≤ 103,4MPa(15000 psi)→ Test pressure = 1,5 x design pressure
103,4MPa (15000 psi)< DP <137,9MPa (20000 psi)→ Test pressure = 0,5 x design pressure + 103,4MPa (15000 psi)
DP >137,9MPa (20000 psi)→ Test pressure = 1,25 x design pressure

5.4.3.1.3 Other equipment

The design pressure of other equipment (e.g. running-, retrieval- and test tools) shall comply with manufacturer's written specifications.

5.4.3.2 External hydrostatic pressure

In subsea applications, external hydrostatic pressure can be higher than internal system pressure. This external loading situation shall be considered, especially relative to seal design, self-sealing couplings and one-atmosphere enclosures. Umbilical and distribution flying-lead collapse during installation and in service shall also be considered.

5.4.3.3 Hydraulic control fluid

Selection of hydraulic control fluid shall consider the maximum temperature and pressure to which the hydraulic fluid can be exposed in the well. The driver for the maximum fluid temperature is likely to be the flowing temperature at the SCSSV. All parts and components in the system shall be compatible with the selected fluid. Reference should be made to Annex C.

The effect of pressure on fluid viscosity may be significant, and shall be addressed for HPHT systems.

The handling and topside safety and environmental implications should be considered carefully in the selection of the control fluid and control fluid distribution system.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

5.4.3.4 Fluid compatibility

Components shall be selected considering compatibility with both control fluid and chemical injection fluid. In addition, compatibility with process fluid, cleaners, preservers, seawater, brines, diesel and corrosion inhibitors shall be considered.

5.4.3.5 System cleanliness

The selected system cleanliness level shall be clearly identified in the manufacturer's written system specification and shall be demonstrated during the testing of the system. Achieving and maintaining fluid cleanliness from component manufacture through life of field should be part of the overall systems approach to design, manufacture, test and operation.

Typical system cleanliness requirements are AS 4059[51], class 6B-F.

All control fluids introduced into the system shall meet the selected cleanliness requirements. Provisions shall be made to maintain cleanliness (e.g. filters) and to take fluid samples.

Methods for circulation and flushing out seawater and solid particle contamination should be considered for the lifetime of the system.

The subsea hydraulic system should be designed to tolerate some contamination by seawater and solid particles. In addition, the components within the hydraulic system shall be tolerant to seawater ingress and the potential corrosion that it can cause. Vulnerable parts with very low fluid consumption (e.g. DCV pilot stages) shall be protected by filters or suitable screens.

System cleanliness should be verified by either

a) extracting a fluid sample from the system in accordance with ISO4021 and analyze it according to ISO 4407, ISO 11500 or ISO 21018-3 as appropriate,

b) connectingan on-line device to the system and analyzing in accordance with ISO 21018.

All parties who can influence fluid cleanliness, including drilling and topside construction personnel, normally unfamiliar with subsea practices, should be made aware of the importance of fluid cleanliness and that working procedures to achieve, test and maintain cleanliness are to the required standard.

5.4.3.6 Component cleanliness

The selected component cleanliness level shall be clearly defined and identified in the manufacturer's written specification and shall be demonstrated during the testing of the component. Achieving and maintaining fluid cleanliness from component manufacture through life of field should be part of the overall systems approach to design, manufacture, test and operation.

5.4.3.7 Seawater ingress and compensation

The potential for ingress of seawater during deployment and use shall be minimized. Recommended measures include removal of residual air, flushing immediately after deployment, pressure compensation orpre pressurizing of the hydraulic system.

The return side compensator shall be sized for the maximum required fluid volume, with a 25 % net margin if the return side compensator is being topped up during operation of the system (looped hydraulic circuit). If the return side compensator is isolated from the supply system, a minimum net (useable)margin of 100 % is required (un-looped hydraulic circuit).

As a minimum, the following situations shall be reviewed:

— compensation of the SCM itself, for retrieval or deployment, when not connected to the XT or manifold;

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

— prevention of hydraulic lock during emergency shutdown;

— the effect of ROV manual over-ride, with- and without external connections;

— fluid shrinkage during cool-down of the well

The pressure compensator maximum calculated fluid volume should consider the following situations, both individually and in worst case combinations:

— pressure compensation effects imposed during subsea retrieval or deployment of individual equipment items, e.g. an individual SCM;

— pressure compensation effects imposed during subsea retrieval and deployment of equipment combinations, e.g. an SCM/Xmas tree assembly.

Care should be taken to ensure that combinations of individual pressure compensation systems do not adversely interact. Specifically, a hydraulic system pressure compensator should operate independently of an associated enclosure oil fill volume compensation system. If it is not possible to avoid interactions, the design should be checked to ensure that the compensation system thermal relief valves lift in the correct sequence.

The use of pressure compensation systems should be considered to prevent hydraulic lock when subsea mating or de-mating of hydraulic couplings during all intermediate stages of subsea system infrastructure construction.

Relative density differences between seawater and internally constrained fluid volumes (e.g. hydraulic control fluids, lubricants, insulating dielectric oils, etc.) can provide a driving force, resulting in significant and continuous fluid transfer mechanisms. These effects should be carefully considered with respect to all potential leakage paths.

Suitable methods of avoiding continuous fluid transfer mechanisms caused by differential fluid densities should be used as appropriate, e.g. anti-siphon techniques, U-Tubes, etc.

5.4.3.8 Overpressure protection at the surface

Provisions shall be made to include a system pressure-relieving device, normally a system pressure relief valve, to ensure that surge pressures in the system do not exceed the design pressure of the system components by more than 10 %.

5.4.3.9 Vibration and pressure pulses

Design of the hydraulic system should consider water hammer, high-pressure pulses and vibration on lines, valves and couplers. This shall include external sources, e.g. chokes. If high cyclic pressure loads are identified, the design and manufacturing should be reviewed to mitigate associated risks.

5.4.4 Chemical supply system

The subsea chemical system should be designed to tolerate contamination by seawater and solid particles. Possible cleanliness or stability requirements for the chemicals should be defined based on the specific application.

5.4.5 Electrical power and communication system

The electrical power for the surface control equipment of an electrohydraulic control system, its associated interfaces, and the subsea equipment should be supplied from an UPS to ensure continued operation in the absence of primary power for a minimum period of 30 min.

Compatibility between vendor electrical utilities used for testing and those available offshore should be verified.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

In case of batteries used subsea for local power storage, the charging status of the batteries should be monitored to ensure continued operation and relevant safety valve closure.

In order to minimize the number of conductors in the control umbilical, signal multiplexing and combining power and signal on the same pair of wires should be considered. Possible increased voltage stress on umbilical or distribution wires caused by single insulation failures should be considered. For subsea assemblies, electrical components of high reliability shall be used. Components shall be procured to industrial grade or better wherever possible.

The design of the subsea electrical distribution system shall consider the possibility of retrieving failed portions of the distribution network whilst the redundant and operational parts are in operation.

With respect to “live disconnect” of subsea wet-mate connectors, consideration should be given to arcing damage that can occur in the event of slow separation speed. Electrical distribution systems should be designed such that “live disconnect” is not required during normal operation, maintenance or, if possible, during failure mode operation or recovery periods.

Topside equipment should be designed to facilitate modular replacement, repair and expansion without requirement for total shut down of the SPCS.

5.4.6 Optical communication system

The fiber optic communication system should be modular and based on a network with open Ethernet standards. It connects the host facility to the subsea nodes.

The central component of the fiber optic communication distribution system is the communication distribution unit (CDU) which incorporates Ethernet devices. It provides an optical interface with the host facility and multiple Ethernet interfaces to the subsea nodes, e.g. the SCM and other devices.

The CDU may also act as a power distribution unit to distribute power to the connected subsea nodes. Optionally a power switch can be placed in the CDU to isolate the subsea nodes separately.

A back-up communication can be realized either via an electrical system or via back-up fibers within the umbilical.

Configurations with fiber optic connections direct to the subsea nodes may also be implemented.

5.4.7 Redundancy

The level of redundancy depends on the actual field development, control system uptime availability target and reliability of equipment used. Generally the following guidelines are applicable:

a) As design intent, the level of redundancy should prevent or minimize the loss of subsea production due to a single-component failure or common-mode failure.

b) Redundancy is most important if component replacement is difficult or if significant production availability or operating capability is lost through single-component failure.

c) If redundant components are used, the reliability of the method for switching from the primary to the backup component should be evaluated. Active redundancy, which enables a seamless transfer to a secondary system in the event of a primary system failure, should be implemented if practical.

d) The subsea electrical distribution system design should be redundant or include spares that can be configured to replace failed circuits. Facilities should be provided to enable routine monitoring of spare-line integrity.

e) Consideration should be given to providing completely segregated redundant power and communication systems. The subsea hydraulic distribution system should be redundant or should include spares that can be configured to replace failed lines in either LP or HP service.

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

f) The subsea chemical-distribution system and supply line should have redundancy consistent with the importance of the treatment chemical.

g) The number of spares in the umbilical should be specified based on the redundancy needed and relative impact on umbilical design, e.g. spares which fill space in a given cross-section add less cost than those which lead to a diameter increase.

h) Redundancy of instruments should be based on criticality and retrievability of the sensors.

i) The level of redundancy throughout the system is influenced by the complexity and reliability. An analysis of the expected benefit from redundancy should be performed for all critical parts of the system.

In design, field layouts should be adopted that enable fault finding and proactive diagnostics which minimise the failure risk of other wells, well groups, or fields.

As a minimum,the following levels of redundancy should be applied to all facilities:

1. Host facility power supplies (non UPS) – Dual redundant power supplies from the host facility to dual redundant subsea control system UPSs, each rated for 100 % of full load. (caution: supplies may be non-synchronous).
2. Host facility UPS feeds – Dual redundant power supply feeds from the host facility UPS to the EPU, each rated for 100 % of full load.
3. MCS input power supplies – Dual redundant input power supplies from UPS, allowing all MCS components to offer dual redundant configuration.
4. MCS output communication channels – 100 % redundancy on all MCS components designed to facilitate dual redundant configuration.
5. Umbilical cores – Dual redundant electrical power supplies, electrical communication channels, optical communication channels, hydraulic power supplies, and key chemical injection supplies that are considered to be operationally required (specific hydrate inhibition requirements, etc.).
6. Dual redundant SEMs should be used to improve system availability.
7. Subsea electrical fault isolation –Any subsea fault on one of the active dual redundant electrical power or communication channels shall not affect operation of the remaining redundant channel. There should be no common mode failures (excluding catastrophic umbilical failure) associated with the electrical and power systems which will affect the remaining channel, i.e. no shared splitters/connectors
8. Subsea hydraulic fault isolation–Any subsea fault on the one of the active dual redundant hydraulic supplies shall not affect operation of the remaining redundant supply.

Dual redundant services (e.g. electrical power supplies, electrical communication channels, and/or optical communication channels) should not be terminated in any single subsea connector.

A key principle of subsea equipment redundancy is to ensure that the system is not exposed to potential single point system failures. In addition, the ability to fault-find a system without disrupting production cannot be achieved if a shared single connector is used.

Discrepancy between redundant choke position monitoring systems should be alarmed.

5.4.8 Reliability

Required reliability of the subsea control system should be optimized to result in maximum benefit. The use of high-reliability components should be compared against redundant components of more standard quality. Special consideration should be given to the reliability of components that are difficult to repair or replace.

Minimum required reliability, mean time to repair and availability targets for subsea equipment should be stated for each project.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

The demonstration of these targets should be part of equipment acceptance criteria.

Critical sensor systems located on subsea trees or manifolds should have component reliability, or reliability obtained by redundancy, that is optimum relative to the need for the sensor data and the risk of subsea intervention. This is most important for sensors that trigger safety or shutdown responses.

Reliability figures for critical components and assemblies should preferably be documented by field data or alternatively justified by calculations, tests or an accepted industry data base,e.g.OREDA)[53].

5.4.9 SIL requirements

It is recommended to apply the safety integrity level (SIL) requirements for topside initiated ESD functions.

5.5 Functional requirements

5.5.1 General performance requirements

Control system equipment built to this part of ISO 13628 should perform in a manner which is efficient, safe and protects the environment. Performance requirements for the control system as a whole should be specified as follows:

— provide for individual or multiple operation of all remotely controlled subsea valves;

— provide sufficient data-readback information to operate the system safely and to react promptly to conditions requiring PSDs;

— provide ESD capability that ensures the subsea system will shutdown production safely within the time specified by this part of ISO 13628 or by applicable regulatory authorities for all production scenarios, including simultaneous drilling, completion and workover operations.

5.5.2 Working pressure

The control system shall be capable of supplying control fluid at a pressure which is sufficient to actuate subsea valves under the most severe operating conditions, as identified by hydraulic analysis, see ISO 13628-4:2011, 7.10.2.2.2, for detailed requirements. The decrease in working pressure shall under no circumstance drop to a value at which any of the other previously actuated subsea valves change commanded position or any DCV moves to an unintended position. The pressure should not drop below 150 % of the highest delatching pressure of any DCV.

Pressure required to operate SCSSV is normally higher than that for wellhead control actuators. As the pressure required to open an SCSSV is a function of the well pressure, which itself is variable over time as the well depletes, the value of the SCSSV hydraulic pressure shall be selected to ensure that the SCSSV is not over-pressured at the end of well life. Placement of an operator-variable SCSSV hydraulic pressure at the HPU mitigates against SCSSV over-pressurizations over well life.

Water depth and, in the case of SCSSVs, the downhole setting depth shall be considered when establishing the appropriate system operating pressure(s).

For high pressure wells, the use of technology (e.g. subsea located pressure intensifiers or SCSSV with reduced operating pressure) should be considered to reduce the high pressure value required topside for safety reasons.

The specific SCSSV manufacturer should define, the maximum and minimum recommended SCSSV hydraulic supply pressure limits to the SPCS manufacturer and addressed in the system hydraulic analysis.

Improvements in hydraulic system operation can normally be achieved by considering the following design features:

a) allow extended valve actuator shift times to enable use of lower quantities of subsea accumulation;

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

b) the use of looped Xmas tree tubing, as defined in A.5 (see figure), where the spring side of actuators is connected into the SCM return line and the enclosed fluid is vented to sea (or return line) during a valve opening operation, can reduce return system back pressures and can significantly reduce ESD vent-down closure times on closed hydraulic circuit. This configuration should not have the facility to allow seawater to enter the hydraulic system.

If a closed hydraulic circuit return line system is used, return line accumulation should be considered to reduce transient local pressure increases.

5.5.3 Fail-safe philosophy

Subsea control systems shall be designed to render the production system in a safe status upon loss of hydraulic power. This can be achieved by either de-energizing of electrical circuits or depressurizing of the hydraulic power supply. If an all-electric-type control system is used, the system shall be fail-safe upon loss of electric power.

There should be no single component failure that prevents the fail-safe closure of the SCSSV and the designated USV.

5.5.4 Response time

5.5.4.1 Valve closing

5.5.4.1.1 General

The primary constraint on control system response time is set by the requirement to execute promptly a shutdown of the subsea production upon command from the surface facilities. Such shutdowns are associated with discharging a supply of combustible materials to the surface facilities, and/or reducing pollution of the environment in the event of a loss in containment integrity of the subsea system. If closure of a valve is the means by which a downstream asset is protected against overpressure, the response shall be faster than that which would allow the segment to be over-pressured due to continued flow. Possible water hammer effects should be considered.

5.5.4.1.2 Requirement for contingency closure control mode

All control systems for which malfunction or failure of the primary control system do not necessarily cause the USVs to return to a fail-safe position, shall be equipped with a contingency closure control mode that can execute the necessary valve closures. If such contingency closure control mode involves bleeding off supply hydraulic pressure, the system shall reset in such a manner as to prevent the automatic reopening of the closed valves when supply pressure is restored. The SCSSVs should be the last valves to close.

5.5.4.1.3 USV closing-time requirement using primary control mode

Upon receipt of a commanded closure, the subsea control system shall complete a closure of the designated USV using the primary control mode with the maximum response time not to exceed 10 min. For multiple-well installations, the USVs on all flowing wells shall close within the designated 10 min time allowance.

5.5.4.1.4 USV closing-time requirement using contingency closure control mode

In the event that a subsea control system failure has necessitated a valve closing operation in a contingency closure control mode that is not in compliance with the 10 min closure-time limitation, the contingency closure control mode shall still execute the closure in a manner that meets the general requirements stated in 5.5.4.1.1.

5.5.4.1.5 Shift time limitation

The shift time portion of the overall closing time for a single USV shall be 3 min or less. This shift time limitation may be waived if flow in the subsea well associated with the respective USV has already been

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

stopped by other valves or flow control devices that have previously been closed or that are simultaneously responding to the commanded closure.

5.5.4.1.6 Failure of boost system

Failure of the boost system shall not prevent the fail-safe closure of the USV under the loss of hydraulic pressure.

5.5.4.1.7 Relationship of surface and riser safety system response requirements to subsea control-system response requirements

The response time of a surface safety valve or riser valve following a commanded closure is established by regional regulations for the protection of the surface facility. The response time of these surface and riser safety devices is independent of the requirements for subsea control system response. As such, this is not a part of this performance specification, but should be considered in a total system safety evaluation.

5.5.4.2 USV valve opening

If equalization of pressure across the USV is not possible prior to opening, the USV shall be constrained to a shift time not to exceed 3 min. This requirement may be waived if there is another valve or flow-control device in the flow stream that can be closed such that the USV can be opened without encountering a prolonged differential pressure.

5.5.4.3 Prediction of system response time

Response time shall be predicted for the full control system prior to fabrication. One of the following methods should be used to verify that the response time meets the objectives.

a) Run a control system simulation using a previously calibrated model for an identical umbilical material, allowing for new variables (e.g. control path length, operating pressure), and end device characteristics.

b) Measure response time directly using similar system configuration and equipment. Justify by calculations and experience the predicted response time.

In addition field performance actuator response time and field dump should be demonstrated and verified against the analysis after installation.

5.5.5 Functional considerations

5.5.5.1 Leak tests and diagnostics

The subsea control system shall be capable of performing required diagnostics and regulatory-mandated leak tests on the subsea equipment. Such leak tests include leak-testing of barrier valves in the HIPPS system, the SCSSV and leak-testing of the designated USV. In the event of leak-test failure, the control system should provide capability to facilitate diagnostics of the failure conditions.

5.5.5.2 Interlocks

The following interlock functions should be evaluated:

— prevent SCSSV from opening unless PMV or PWV is closed;

— prevent SCSSV from closing unless PMV or PWV is closed;

— prevent the cross-over valve from opening unless PMV is closed;

— prevent the PWV from opening unless choke is at preset position.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

5.5.5.3 SCSSV or intelligent well completion seal failure

Backflow of well fluids into the subsea control system due to seal failure in the SCSSV or IWCS shall not impair the ability of the subsea control system to execute the fail-safe closure of the USV.

The potential for gas hydrate formation on vent-to-sea relief valves that results from SCSSV or IWCS seal failure should be considered. If appropriate, suitable measures should be taken to avoid compromising well control.

The impact of hydrocarbon ingress on SCM performance that results from a SCSSV or IWCS seal failure should also be considered. If appropriate, suitable measures should be taken to avoid compromising well operations.

In the case of SCSSV and “smart well” downhole device hydraulic actuation, the hydraulic system design shall address the following environmental and operational issues associated with potential gas leakage past the devices into the hydraulic function line(s):

— provision of downhole function line isolation facilities should be considered;

— downhole device cycling should be minimised;

— SCM SCSSV vent-to-sea ports shall be segregated from LP tree valve ports;

— the potential for hydrate formation on SCM downhole vent-to-sea ports should be considered and mitigated against.

5.5.5.4 Actuation indication

The production control system shall provide a surface indication of the actuation of a selected hydraulic function. As appropriate to the hardware, such indication may be through the use of visual flow indicators, pressure transducers, pressure gauges, position-indication sensors, flow sensors or pressure sensors.

5.5.5.5 Protection of SCSSV

Under commanded-closure conditions, the design of the production control system should protect the SCSSV from slam or creep closure on a flowing stream, through operational procedure or introduction of a delay following the closure of the valves downstream of the SCSSV. Any such provision should not impact the ability of the subsea production control system to close the SCSSV in shutdown conditions.

5.5.5.6 Flushing of SCSSV hydraulic circuit

Provisions for flushing the hydraulic circuit from control module to SCSSV during installation and in the operational phase shall be considered as part of front-end engineering. This function can be implemented by using a dedicated flushing valve in the SCM. Flushing operations shall not result in HP system pressure drop which can affect other wells.

5.5.5.7 Safety isolation during workover

The production control system shall be capable of being positively disabled from the operation of tree control functions while a workover control system is in use on that tree.

5.5.5.8 Control fluid venting and leakage

External venting and leakage of control fluids shall not exceed local regulatory requirements. Internal leakage shall not exceed the control component manufacturer’s written specifications. Margins for leakage increase shall be allowed.

Internal leakage shall not threaten the safe operation of the isolation valves particularly the ability to shut-in.

For closed hydraulic circuits the return system shall be sized for the maximum internal leakage.

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

5.5.5.9 Load capability

Product designs shall be capable of sustaining rated loads without degradation, exceeding the allowable stresses or impairment of other performance requirements.

5.6 Design requirements

5.6.1 General design requirements

The design shall provide for reliable and safe operation of the subsea equipment. The design shall also provide means for a safe shutdown on failures of the equipment or on loss of control from the remote control point.

Vulnerable areas for connection (e.g. electrical connectors, hydraulic couplers and stabplates) shall be furnished with necessary protection equipment in order to protect the equipment when being unmated and in service and to prevent calcareous build-up and marine growth.

Early in the project, the manufacturer and purchaser should clearly establish utility interface requirements.

Special safety considerations (with respect to personnel) should be paid to electrical components that are deliberately electrically isolated from their supporting equipment during surface testing programmes to mitigate against potentially hazardous internal earth faults.

5.6.2 Closed loop control

A subsea production control system may require active control functionality which is time critical and needs to respond in a closed loop manner. Time constants for all active control loops shall be established. The control system shall meet all requirements driven from the respective time constants.

Control loops may be closed through application software at host facility or through application software local to the process subsea. In case of local control special emphasis shall be taken regarding shut down functionality and safety integrity level of the control loop.

The production control system shall be designed for ease of tuning of active control parameters to optimise control performance based on operational experience.

Examples of closed loop control applications which may form part of a subsea production control system may include, but are not limited to

— subsea separation,

— subsea boosting,

— gas compression,

— anti surge control,

— active chemical dosing,

— magnetic bearing control,

— active choke control.

During system design, segregation of closed loop control functionality and well control functionality shall be considered.

For systems that include closed loop control of rotating machinery (e.g. subsea compression) inclusion of sensors which will enable early warning of impending failures should be considered.

HIPPS functionality is defined in 7.4.10.3.

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

5.6.3 Design methods

5.6.3.1 Pressure-containing vessels

All pressure-containing vessels used for applications in excess of 0,1 MPa (15 psi) shall meet the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, or BS 7201-1 or ISO 10945 or any other agreed-upon pressure vessel or accumulator code or standard.

NOTE For the purposes of this provision, BS 7201-2[17] is the equivalent of ISO 10945.

5.6.3.2 Electrical devices

All electrically driven motors, motor starters and all other electrical devices shall conform to the requirements of the appropriate approved electrical code for the equipment location.

5.6.3.3 Interconnecting tubing

Vibration-induced fatigue failure of the subsea tubing system shall be considered. All tubing runs shall be installed with sufficient and appropriate clamps. Interconnecting tubing shall meet the requirements of ANSI/ASME B31.3 or any other agreed upon piping code or standard.

5.6.3.4 Components containing software and configuration data

The software design, development and maintenance of all subsea production system software shall be controlled and verified. This includes both software contained within production control system components, and systems used during testing and installation of subsea production control system components.

Configuration data used within subsea control system components shall be maintained and controlled using a documented configuration management system.

5.6.4 Design analysis

5.6.4.1 General

The following analyses shall be performed of the production control system for the purpose of establishing system requirements (e.g. performance characteristics, requirements, etc.), and only if they are relevant to the type of control system.

Analysis work shall include an appropriate subset of the following for the purpose of establishing system requirements, e.g. performance characteristics, requirements, etc.:

— hydraulic and electrical power requirements for valve operations;

— hydraulic system operation and response time analysis;

— electrical power distribution analysis;

— communication analysis;

— failure mode effects and criticality analysis;

— reliability, availability, maintainability analysis;

— safety assessment analysis;

— structural (static) analysis.

AVA Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

5.6.4.2 Hydraulic systems

Hydraulic system analyses should ensure that the hydraulic system performance in the various modes of operation is safe and operationally acceptable.

A simulation of the control system shall be created, and analysis made, such that the required opening and closing time requirements for the system can be verified. The response time of the control system shall be simulated in the absence of any bore-pressure assistance to the closure of the valve. The simulation shall properly account for response-time degradation due to use of high density gradient and high viscosity control fluids. Effects of a boost-pressure supply acting to assist the prompt closure of the valve operator may be included in the analysis. However, this does not relieve the supplier from providing a system that meets the requirements of this part of ISO 13628 without the use of a boost system.

The areas of hydraulic performance that should be addressed are the following:

— time to prime the hydraulic system from a depressurized state;

— opening and closing response times of the process valves under conditions of minimum and maximum process pressure;

— time for the pressure to recover following a process valve opening;

— time to carry out a sequence of valve openings, e.g. the opening of a tree;

— time to carry out a specified sequence of well open or close operations;

— stability of opened control and process valves to pressure transients caused by operation of other control and process valves (unintended control valve delatchingor partial closing, process valve partial closing, etc.);

— stability of opened downhole control and safety valves to pressure transients caused by operation of other safety or IWCS valves (unintended control valve delatching, process valve partial closing, etc.);

— response time to close process valves in the event of a common close command, e.g. an ESD vent-down at the surface, venting off hydraulic control valves via supply lines;

— response time and pressure for multiple simultaneous choke operations;

— response time and pressure for subsea quick dump;

— response and pressure for closed hydraulic circuits;

— peak return-line pressure transients that can cause partial opening of closed process valves and damage to hydraulic components with limited return-pressure capability;

— impact that failure of subsea accumulation and return-line boost pressure systems (assist closing systems) has upon the safe operation and closure of the process valves;

— impact of loss of subsea accumulator pre-charge;

— extent of control fluid total loss rate;

— hydrostatic conditions that can give rise to line collapse, seawater ingress, etc., caused by differential hydrostatic pressures resulting from differential heads and differential fluid densities;

— chemical system flow analysis that should establish that a specified supply of well-treatment, start-up and shut-down chemicals is achieved under the range of wellhead flowing and shut-in process pressures.

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

X-mas tree actuator hydraulic systems should be looped to exhaust control fluid to sea (for open hydraulic circuit) or to the umbilical return line (for closed hydraulic circuit) during the actuator opening stroke. This system offers the following operational improvements and inherent safety features:

— reflected or accumulated pressures in the return line will not cause closed process valves to unintentionally partially or fully open;

— the sea chest/compensator is routinely topped up when valve actuators are stroked open (excess fluid should not vent to sea until the sea chest is full);

— closed hydraulic circuit failsafe valve closure times can be significantly reduced as fluid can loop around the Xmas tree return line tubing rather than returning to the surface via the return line;

— the fluid transfer loop should facilitate the use of ROV deployed actuator override systems without the need for any auxiliary downlines or fluid compensation systems;

— the use of looped actuator configurations should be optional for remote valves and/or manifold valves if such a system would require individual or common return lines.

5.6.4.3 Electrical control power systems

The electrical power distribution analysis should establish the following:

— voltage at SEM for maximum and minimum SEM power loads;

— voltages at SEM at maximum and minimum numbers of SCM on the subsea electrical distribution line;

— voltages at SEM at minimum and maximum umbilical lengths;

— voltages at SEM at redundant and non-redundant power distribution, if applicable;

— voltages at SEM at cable parameters for dry and wet umbilical insulations, if applicable;

— voltages at SEM at the limits of cable parameters, e.g. inductance, capacitance, resistance and conductance (noting that some parameters may change when subsea);

— SEM component stress levels that should be maintained within acceptable limits for normal and degraded modes of operation;

— minimum and maximum subsea power requirements;

— maximum current load;

— power factors for full range of control system operating conditions.

5.6.4.4 Electrical actuator power systems

The electrical actuator power analysis should establish the following:

— voltage at actuator for maximum and minimum load;

— the minimum stored power for specified subsea valve operation, if local battery power is used;

— opening and closing response times of the process valves under conditions of minimum and maximum process pressure;

— time to recover following a process valve stroking;

— time to carry out a sequence of valve openings, e.g. the opening of a tree;

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

— time to carry out a specified sequence of well open or close operations;

— stability of opened downhole control and safety valves to transients caused by other operations;

— response time to close process valves in the event of a common close command;

— response time for multiple simultaneous choke operations.

5.6.4.5 Communication systems

The electrical and optical communication system analysis should establish the following:

— communication requirements for valve operations and data transfer;

— frame loss rate and throughput (as defined in RFC1242) and signal-to-noise in SEM and topside at minimum and maximum umbilical lengths;

— subsea communication data transfer response time for downlink commands and uplink data transfer. The response time shall be calculated for the maximum number of data points and maximum number of SEM connected to one line and include communication load from possible other users like IWCS;

— In the case where IWCS share the same communication link as the production control system, special consideration shall be made to communication system operation during critical functions like PSD to ensure the safety integrity level specified is maintained.

5.6.4.5.1 Electrical communication systems

The electrical communication analysis should establish the following:

— signal voltage in SEM and topside at minimum and maximum umbilical lengths;

— signal voltage in SEM and topside at maximum and minimum numbers of SCM on the subsea electrical distribution;

— signal voltages in SEM and topside at worst-case cable transmission line parameters, e.g. inductance, capacitance, resistance and conductance (noting that some parameters can change when subsea and are also subject to discrepancies between calculated and manufactured values);

— interference from the subsea and topside power supplies or other sources of electromagnetic energy in the signal frequency band;

— power frequency components in subsea and topside receivers;

— UPS power frequencies in the signal frequency band;

— Signal near- and far end cross talk between umbilical lines;

— signal voltage in SEM and topside at cable parameters for dry and wet umbilical insulations;

— acceptable amplitude variation within the frequency band required by the modem system at minimum and maximum numbers of SCM on the subsea electrical distribution.

5.6.4.5.2 Optical communication systems

The optical communication analysis should establish the following:

— optical power budget in subsea equipment and topside at minimum and maximum umbilical lengths;

AVA Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10

— optical power budget in subsea equipment and topside at maximum and minimum numbers of subsea nodes;

— optical power budget in subsea equipment and topside at worst-case transmission line parameters, including maximum number of interconnections.

5.6.5 Design review

Control-system design documentation shall be reviewed and verified by a competent individual other than the individual who created the original design.

The design verification of the subsea components shall be sufficiently rigorous to reflect the importance and cost of repair if it should fail. Such verification of design shall include all life phases, e.g. installation, operation and recovery.

5.6.6 Control system design documentation

5.6.6.1 Manufacturer's engineering data records

Engineering data records shall include required analyses listed in 5.6.3, other design analyses performed by the manufacturer and FAT procedures and records.

5.6.6.2 Installation, operating and maintenance manual

The installation, operating and maintenance manual should incorporate information on the following:

a) installation procedures:

The manufacturer shall write procedures that prepare the equipment for installation and commissioning in a manner which is effective and minimizes the risk of damage. The procedures shall cover the testing of control modules, control umbilicals and connections just prior to, during, and immediately following installation.

b) operating procedures:

Operating procedures shall be prepared for use by field personnel and service technicians, and should include adequate schematics and block diagrams. They shall define the following:

1) general description and features:

   This portion shall describe the function of each major component of the system and define its capabilities and interfaces with other components.

2) general function and shutdown philosophy:

   This information shall include block diagrams, panel logic and schematics that represent the control system. Sensor-initiated inputs and outputs should be included. The interface between the operating circuits on host facilities, instrument and emergency utilities (e.g. air, water and electricity), shall be included. The nature and purpose of all signals to and from the surface-facility fire and safety systems, motor control centre, and supervisory controls shall be identified. The approximate time required for shutdown actions to occur should be noted.

3) system checkout:

   The system checkout shall be based on FAT and integrated tests described in Clause 11. The purpose of the procedure is to verify the correct function of all shutdown inputs and safety devices, and to verify the correct setting of all control system adjustments. The procedure should be written to allow testing to the fullest possible extent without interrupting well production. Where mechanical or electrical overrides are required, their active status shall be clearly indicated. A document should be

Documents
Document Sharing Hub
Full document details: E DIN EN ISO 13628-6:2011-10

prepared that collects all the set points and allowable ranges for the process variables. This document can be updated as needed and attached to the procedures.

The system checkout shall include a test and documentation of the safety shutdown system.

4) maintenance procedures:

The manufacturer shall furnish suitable instructions concerning field assembly and maintenance of the equipment. Instructions for periodic checks and/or replacement of control system surface equipment should be included.

5.6.6.3 Manufacturer's data record book

The manufacturer shall collect data record information for the supplied equipment, including subcontractor supplied equipment as required by the customer. The following should be included:

— general assembly drawings with list of materials;

— electrical schematics;

— hydraulic schematics;

— interface drawings;

— material certificates with appropriate test reports;

— component data sheets, including performance specifications;

— load test reports;

— welding procedures;

— certificates of conformance.

6 Surface equipment

6.1 General

The purpose of this clause is to set forth additional requirements that are specific to the surface-installed equipment that is part of a subsea production control system. All such surface-installed equipment shall be designed to perform in accordance with these additional requirements.

6.2 General requirements

Host facility-based production control system equipment should be built and documented according to specifications applicable for the host facility where the equipment will be located. Relevant standards and installation specifications should be a part of the contractual documentation for the specific project.

6.3 Functional requirements

The functional requirements for the surface equipment typically include all or some of the following:

— supply and conditioning of electric and/or hydraulic power for the subsea equipment;

— communication with the subsea equipment;

— control and monitoring of subsea equipment;

— communication with the host process equipment;

Documents
Document Sharing Hub

Full document details: E DIN EN ISO 13628-6:2011-10