



Exploration & Production

GENERAL SPECIFICATION

GEO INFORMATION

GS EP GIN 122

Deliverables and Delivery Procedures for Surface Seismic Acquisition and Processing Data

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Rev.	Date	Notes

Owner: EXPLO/IGEO	Managing entity: EXPLO/IGEO/DER
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1. Scope

The standards defined below are mandatory requirements for all seismic data sent to Total Seismic Archives Department.

Are detailed the digital files header contents, the external labeling of the media used, as well as the accompanying documents. Are also specified to whom and in which way these documents should be sent to the archives.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



Total General Specifications

Reference	Title
GS EP GIN 121	Seismic Data Identifiers, Naming conventions for Topographic and Navigation Data files

3. Rejected Data

Whenever data is not documented sufficiently, thus leading to possible confusion, Total has the right to refuse delivery.

For example, processed data including any of the following weaknesses will be refused:

- SEGY header suffering from lack of information,
- SEGY header using internal jargon words.
- SEGY header (3200 bytes block) identical over different processing final products
- Country name missing on label or on tape header
- Wrong information on tape labels, for example:
 - Identical labels, with the same range of lines, on different tapes
 - lines on the tapes not matching names indicated on the labels.

4. Deliverables

4.1 Prerequisite

- Each item delivered to Company must be labeled with the **SI** number as specified in **GS EP GIN 121** and in all related contracts.
- Prior to generating the final tapes data, one sample will be provided to Company Supervisor for the purpose of tapes and trace headers labeling QC.
- A draft of the final report will be provided to Company Supervisor for review prior to distribution.
- All tape products shall be kept in Contractor processing centre until successful QC of the sampling has been confirmed by Company Supervisor.
- Survey references are coherent with contract's scope of work.

Country	<i>To be provided by Company</i>
Block name	<i>To be provided by Company</i>
Field name	<i>To be provided by Company</i>
Survey name	<i>To be provided by Company</i>
Seismic Identifier (PSI or ASI, processing or acquisition resp.)	<i>To be provided by Company (see GS EP GIN 121 for details)</i>



4.2 Seismic Tapes

Seismic data shall be delivered in SEG-Y format, as described in Appendix 1 (**SEG-Y Recording Formats for Processed Seismic Data**) on the media defined in paragraph 4.5.2

All tapes delivered will be brand new.

Each tape will be write protected.

4.2.1 Tape labels

Labels must include the following information:

1. SI number (To be provided by Company)
2. Company Name (To be provided by Company)
3. Block name as defined in Paragraph 4.1
4. Field name as defined in Paragraph 4.1
5. Data Type as defined in Paragraph
6. Line numbers and CMP ranges
7. Creation date
8. Tape number
9. Format and Bytes/sample
10. For stacked data: minimum amplitude and maximum amplitude values of the dataset.

4.2.2 Tape headers

Standard SEG-Y EBCDIC header format must be used, as described in Appendix 1.

The processing sequence must be detailed in the EBCDIC header:

Main steps must be clearly described and the specific or proprietary name of the tool should only be indicated in parentheses.

Example:

step 14) KIRCHOFF PSTM (XXXX) **(correct)**
step 14) XXXX **(rejected)**

It is mandatory to have Company supervisor's agreement of this text prior to tape sets generation.

4.2.3 Trace Headers

All available ident information shall be copied to the relevant **SEG-Y** headers as defined in Appendix 1 Table 2.

4.2.4 Seismic processing report

Contractor shall supply within 30 days after workstation tapes delivery a "Seismic Processing Report" including all details on the processing, testing and parameter decisions, diagnostics, QC steps and details on final processed data delivered to Company.

Report shall be written in English unless otherwise indicated.



4.2.5 General requirements

The report shall contain all information required to provide a thorough understanding of sequences, issues, decisions, shortcomings and results. The report should nevertheless be concise, and enclosures be A4 size and in color.

The report shall be provided in a paper and CD-ROM support with the items defined in the paragraphs below.

The CD-ROM version will contain MSWORD, PowerPoint and EXCEL files as further detailed.

4.2.6 Report content (paper copy and CDROM).

The report in MSWORD will contain the following items:

- **Title page**

Country"

Block, area or field name

Survey(s) name

Seismic (Re)Processing Final Report

Processing start and end dates

Seismic Identifier (SI)

- **Details:**

- An introduction outlining the scope of the report and general background to the processing, e.g. area and date of data acquisition, location and date of data processing, project numbers
- Description of the tests carried out and resulting parameter choice decisions
- Any special data-related problems encountered, e.g. consistently bad data channels, erroneous changes in field-recordings filters, other noise problems such as spikes, noise trains and the solution to these problems.
- Static correction details, if relevant, including qualitative assessment of field statics supplied and the influence of information supplied by Company on decisions made and QC products used.
- Velocity analysis methodology and QC details,
- Names of personnel actually involved in processing the data.
- Flowcharts showing the complete processing sequence applied and parameters chosen.
- Conclusions and technical recommendations with respect to present processing as well as for subsequent seismic acquisition in the area (acquisition parameters, acquisition direction, etc...).
- Original and final Gantt charts
- For each of stacked data set, the following information will be provided:
 - Minimum amplitude value
 - Maximum amplitude value



- Amplitude values Histogram.

PowerPoint format:

- All key processing steps will be illustrated by clearly labeled examples.

4.3 Miscellaneous (CDROM only)

- All meetings minutes and technical notes (MsWord and PowerPoint formats).
- Bin position file
- De-signature or minimum phasing operator

Recorded and/or modeled Far field signature.

4.4 General Information in EXCEL format on CDROM

Contractor is required to provide a table containing the following items:

Type of information	Comment
PROJECT NAME	As Per A.1.1
Seismic processing Identifier	As per PSI Provided
Seismic acquisition identifier(s)	As per ASI(s) provided
Processing CONTRACTOR name	
Processing team	Processing author
Title of processing job	As per CONTRACT Title
Processing start date	
Processing end date	
Transmittal date	
Geodetic Datum Name	As per paragraph A.3
Ellipsoid Name	
Projection	
3D corners (X,Y positions) fold 1	
Format of topographic file	UKOOA format mandatory
Type of tape	Tape brand, Tape density, Tape format

4.5 Seismic tapes information

- For 2D data

Tape identification	Date of creation	Processing type	Data Format	Processing line name	First CDP	Last CDP	First SP	Last SP
Reel number	mm/yyyy	stack, final migration, PSTM CMP, ...	SEG-Y, ...	Prefix + line number				



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➤ For 3D marine data

The sail line and processed lines correspondence will be provided in the form described in the example below.

Reel number	Creation date (mm/yyyy)	Processing type	Data format	Sail line	Seq. No.	Fcdp	Lcdp	Fline	Lline	Swath	Swath	Swath	Swath	Swath
1				4950-248	31-248	3188	3457	4959	4979		101			
2				4970-245	31-245	3191	3412	4974	4992		101	102		
3				4990-242	31-242	3188	3697	4986	5005		101	102		
4				5010I-239	31-239	3191	3616	4999	5021		101	102		
5				5010A-236	31-236	3189	3945	5011	5030			102	103	
6				5010-233	31-233	3192	3892	5016	5047			102	103	
7				5030-230	31-230	3187	4079	5028	5059			102	103	
8				5050-227	31-227	3191	4063	5046	5066				103	
9				5070-224	31-224	3190	4393	5063	5081				103	104
10				5090A-221	31-221	3193	3944	5068	5099				103	104
11				5090B-294	31-294	3592	4532	5072	5098				103	104
12				5090-218	31-218	3190	4556	5084	5109					104
13				5110-215	31-215	3193	4533	5093	5118	105				104
14				5130-270	31-270	3188	4825	5111	5133	105				104
15				5130I-273	31-273	3191	4743	5128	5147	105				
16				5150I-277	31-277	2873	4884	5138	5165	105	106			
17				5150A-331	31-331	3916	5013	5146	5179	105	106			
18				5150-267	31-267	2873	4841	5147	5170	105	106			
19				5170-264	31-264	2860	5257	5163	5188		106			
20				5190-120	31-120	2869	5232	5175	5200		106	107		
21				5210-253	31-253	2846	5379	5189	5217		106	107		
22				5210I-261	31-261	2847	5515	5198	5232		106	107	108	



4.5.1 Data shipment instructions

A transmittal letter shall be included in all data shipments.

A copy of this transmittal shall be emailed, prior to the shipment, to all the addressees defined in 4.5.2 as well as to Company Supervisor together with the Excel files defined in paragraphs [4.4](#) and [4.5](#).

The Transmittal shall include the following information:

- Originator
- Survey name and year
- Type of data
- Date
- **SI** number (PSI for processing, ASI for Acquisition)
- Carrier

All tapes should be shipped in their original boxes as used by the manufacturer.

All boxes should be labeled with a box sequence number and with a list of tapes present. The box numbers should be unique for a single data set, e.g. if a data is sent in two shipments, the box numbers of both shipments should not overlap.

Excel files defined in paragraphs 4.4 and 0 will be provided on CDROM on the last tapes shipment.



4.5.2 List of deliverables and addresses

Delivery of the following final products and displays as described below are included in the STANDARD PROCESSING SEQUENCE rates as provided in [EXHIBIT 4](#).

Addressee			Subsidiary Address Name email		Partner 1 Address Name email		Partner 2 Address Name email	
Total E&P CSTJF Bur B008 DGEP/EXPLO/IGEO/DER/DS Att: J. FONTANA Avenue Larribau - 64018 PAU CEDEX France ep-igeo-dtr.seismic- archive@total.com								
ITEMS	Quantity	Media	Quantity	Media	Quantity	Media	Quantity	Media
Step 4 of processing sequence	1	IBM 3592						
Step 20 of processing sequence								
Step 25 of processing sequence								
Step 31 of processing sequence								
Step 37 of processing sequence	1	IBM 3592						
	1	DLT						
Seismic Processing Final Report step 38	2	CD						



5. Appendix 1: Requested seg-y format

5.1 Origin of format

This format is an extended version of the PESGB/SEG proposals [1] for SEG-Y revision 1. It makes use of extensions in that draft that are in accordance with the original SEG-Y specification. There are additional proposals that should be implemented as soon as the SEG approves the revised SEG-Y format. These are noted in italics in this document.

SEG-Y file organization

Each file shall be terminated by an EOF mark.

Data shall be written in the standard SEG-Y floating point format (IBM short floating point).

N.B. use the IEEE 32 bit floating point format as soon as it is accepted.

The first data sample shall always correspond to time = zero ms.

A double EOF shall signify the end of media for tapes.

5.2 SEG-Y Reel headers

Each file shall contain one reel identification header of 3600 bytes that is divided into two parts. The card image EBCDIC block (3200 bytes) and the binary coded block (400 bytes) recorded as separate records.

The PESGB proposal includes an option to write this header block in ASCII format.

The following information shall be recorded in the SEG-Y EBCDIC file header: survey name, survey number, processing Contractor:

Acquisition details

Processing summary

Polarity of data

Details of codes used in trace header words

Source identification

Receiver identification

Source, receiver, elevation identification

Phase of data

Definition of projection system used for co-ordinates

CDP bin definition - origin, azimuth, bin size and row, column ordinals with X, Y values for a CDP further from the origin than any CDP in the survey

5.3 SEG-Y EBCDIC Reel header

Table 1 shows an example SEG-Y EBCDIC file header where user entries are shown in italic. The EBCDIC file header only contains 3200 bytes, many of which are pre-defined by the format.



Table 1 Example SEG-Y EBCDIC reel header

Standard SEG-Y Header EBCDIC card images								Note	M/O
1	2	3	4	5	6	7	8		
1234567890123456789012345678901234567890123456789012345678901234567890									
C 1 COMPANY TOTAL xxx CONTRACTOR ccccc PROCESSING IDE:PROCESSING SI NUMBER								1	M
C 2 LINE PREFIX&NUMBER AREA bbbbbbbbbbbbb ACQUISITION IDE ACQUISITION SI NUMBER								2	M
C 3 REEL NO rrrrrrrr FILE NO nnnn FIRST ENS IIII LAST ENS IIIII DATE DD/MM/YY								3	M
C 4 INSTRUMENT: MFG MODEL SERIAL NO								4	O
C 5 DATA TRACES/RECORD AUXILIARY TRACES/RECORD CDP FOLD								4	M
C 6 SAMPLE INTERVAL SAMPLES/TRACE BYTES/SAMPLE								4	O
C 7 RECORDING ACQUISITION FORMAT								4	M
C 8 SAMPLE CODE: FLOATING PT (IBM SFP) ENVIRONMENT LAND/MARINE 2D/3D 1C/2C/\$C								5	M
C 9 "LAST PROCESS"								6	O
C10 FILTERS: ALIAS HZ NOTCH HZ BAND - HZ SLOPE - DB/OCT								7	O
C11 SOURCE: TYPE NUMBER/POINT POINT INTERVAL								8	M
C12 MULTIPLE SOURCE DETAILS IF APPLICABLE								9	P
C13 SOURCE TYPE IDENTIFICATION BOAT IDENTIFICATION								9	M
C14 CABLE:IN-LINE: NEAR OFFSET NNNN.N FAR OFFSET NNNNN.N GROUP INTERVAL NN.N								10	P
C15 HYDROPHONES: PER GROUP SPACING FREQUENCY MFG MODEL								10	P
C16 NUMBER OF STREAMERS NN CROSS LINE OFFSET CABLE 1 NNNN.N SPACING NNN.N								10	P
C17 CABLE IDENTIFICATION:								10	P
C18 RECEIVER IDENTIFICATION:								11	P
C19 TRACES SORTED BY: RECORD CDP OTHER								12	M
C20 AMPLITUDE RECOVERY: NONE SPHERICAL DIV AGC OTHER								13	M
C21 EPSG COORDINATE SYS CODE: EEEEE NAME "EPSG COORDINATE SYSTEM NAME"								14	M
C22 PROCESSING: PROCESSING SEQUENCE DESCR. AS AGREED BY TOTAL REPRESENTATIVE								15	M
C23 PROCESSING									
C24 PROCESSING									
C25 PROCESSING:									
C26 PROCESSING:									
C27 PROCESSING:									
C28 PROCESSING:									
C29 PROCESSING:									
C30 PROCESSING:									
C31 PROCESSING:									
C32 PROCESSING:									
C33 PROCESSING:									
C34 CDP GRID: ORIGIN: AZIMUTH								16	P
C35 CDP BIN SIZE:								16	P
C36 INLINE IIII XLINE CCCC XXXXX,YYYYY INLINE IIII XLINE CCCC XXXXX,YYYYY								17	P
C37 INLINE IIII XLINE CCCC XXXXX,YYYYY INLINE IIII XLINE CCCC XXXXX,YYYYY								17	
C38 CDP/LINE NUMBER CONVENTION								18	P
C39 POLARITY PHASE								19	M
C40 END EBCDIC - COMPANY VERSION 1.DEC 2004								20	M

Notes:

M = mandatory – must be present and have the appropriate values

P = mandatory if relevant – if the values can be specified then these header fields are mandatory

O = optional for processed data



The optional card images may be omitted to make more space for processing information.

The card images that define the use of trace header codes, the projection system and the binning system can be expanded to provide a full description.

1. xxxxxx is the Company extension. cccccc.. is the processing Contractors name, iiiiiiiiiiiii.. is the Company processing IDE.
2. iiiiiiiiii... is the fully pre-fixed Company line number for acquisition ordered data, for sorted data it is the processing Contractors line number with the Company prefixes. bbbbbbbb is Company area designation or block number,
3. The reel number rrrrrrrr should be the reel assigned by the processing Contractor for native data. The file number nnnn is the sequential file number for this file, it can be used for fast access on many modern systems. The date is the date that this file was created (the last major processing event).
4. Acquisition details these should be consistent for all data from the acquisition project. A processing project may include data from two or more acquisition projects. Sufficient information should be included to identify the acquisition projects and the characteristics of the original data.
5. This data is free format, Contractors may use any suitable layout that allows future users to understand how the data were acquired.
6. IBM short floating point is the only floating point number format defined in the original release of SEG-Y. This format is not used by any modern workstation and IEEE numbers should be used as soon as the revised SEG-Y standard is published. The ENVIRONMENT flags are required, initial options are LAND, MARINE, OBC (ocean bottom cable), combined with 2D or 3D and the number of components recorded. Other data such as VSP should be defined using appropriate terms from Sheriff's Encyclopedia of Geophysics [2].
7. The current state of the data – last process applied and data sort order. The process state should be one of "IDENT", "SIGNAL", "DMO", "PS-MIG", "STACK" or "MIGRATE".

IDENT = data has been reformatted and merged with navigation and field edits

SIGNAL = data has had non-linear signal processing applied (deconvolution, FK filtering etc), this data can be in field order, sorted into subsurface lines or even sorted into 3D CDPs.

DMO = pre-stack DMO data in final CDP order

PS-MIG = pre-stack migrated data in the final CDP order.

STACK = data that has been stacked but has not migrated

MIGRATE = data that has been stacked and migrated

8. The filter specification should indicate the potential bandwidth of the data, for example if the data was recorded with no low cut in the field and an 8Hz 36 dB/octave filter applied in processing then the 8 Hz 36 dB/octave should be specified.
9. The source type should identify the generic source used
10. Multiple sources – e.g. port and starboard arrays offset 25 m from the ship centerline
Use as many cards as required to describe the source configuration
The header must show how the sources can be identified from the trace header field (bytes 211-212)



11. Streamer specification and identification should be sufficient to describe each streamer and allow the user to understand the streamer code in the trace header.
12. The receiver identification allows the specification of multi-component data
13. The actual trace sort type should be specified
14. Specify any amplitude conditioning applied to the data.
15. The European Petroleum Survey Group (EPSG) have produced a database of geodetic information. [3] The projection should be described using the reference number and name
16. The generic processing description should use terms from Sheriff's dictionary of Geophysics.
If the processing includes depth conversion and this data is in the depth domain then the sample intervals and sample units should be specified in meters.
17. The processing CONTRACTOR's grid definition for the 3D bins, defined using the standard UKOOA notation.
18. The CDP grid ordinals and co-ordinates for a bounding polygon containing the survey.
19. The processing Contractor CDP and line number conventions
20. Polarity is either "NORMAL SEG" or "REVERSE SEG" and Phase is either one of "AS RECORDED", "MINIMUM PHASE" or "ZERO PHASE".
21. The version number and date of this annex shall be specified in the last line of the header.

5.4 SEG-Y Binary Reel Header

The following information is required for the binary coded reel header

Bytes 3201 - 3204 Numerical part of the Company processing IDE

Bytes 3205 - 3208 Numerical part of the line number

Bytes 3209 - 3212 Reel number (being the numerical part of the barcode)

Bytes 3213 - 3214 Number of data traces per record after spatial re-sampling (include dummy and zero traces inserted to fill out the shot record) N.B. this is the number of traces per shot record used for processing.

Bytes 3215 - 3216 Number of auxiliary traces per record (e.g. gun signatures for "IDENT" data set)

Bytes 3217 - 3218 Sample interval in microseconds (or meters for depth domain data)

Bytes 3221 - 3222 Number of samples per trace - (this should be the maximum for this file)

Bytes 3225 - 3226 Data sample format code

1 = IBM short floating point (32 bit hexadecimal)

2 = 4 byte integer

3 = 2 byte integer always scale so that the RMS level is 2000

The scaling can be done on either a trace by trace basis, the entire SEG-Y file or even the entire survey if the interpreters intend to use seismic amplitudes

4 = 4 byte fixed point with gain - *deprecated* – **do not use**



5 = 4 byte IEEE floating point (big-endian) - proposed by PESGB / SEG data-management group

Bytes 3227 - 3228 CDP fold - expected fold for this file (or entire dataset). The actual fold may be greater as a result of binning or repeated shots.

Bytes 3229 - 3230 Trace sorting code:

1. = As recorded
2. = CDP ensemble
3. = single fold continuous profile
4. = horizontally stacked
5. = sub surface shot order – additional code not defined in SEG-Y
6. = common offset planes – additional code not defined in SEG-Y

Bytes 3255 -3256 Measurement system (always set to 1 = Meters)

Bytes 3501-3502 SEG-Y revision 1 = 0100₁₆

Bytes 3503-3504 Fixed trace length flag – set to 1 if all the SEG-Y traces have the same length.

5.5 SEG-Y Trace Headers

Table 2 SEG-Y trace headers for seismic data

Bytes	Description	Ident	Signal	Pre-Stack	Post stack	Notes
1-4	Trace sequence number within line – first trace is 1.	M	M	M	M	
5-8	Trace sequence number for this file (tape)	M	M	M	M	1
9-12	Original field record number	M	M	M	-	
13-16	Trace sequence number within shot record	M	M	M	-	2
17-20	Energy source point number (allows multiple shots at one shot point) – normally insert the nearest shot point location	M	O	O	-	3
21-24	2D or 3D CDP ensemble number as defined by the processing CONTRACTOR	O	O	M	M	4
25-28	Trace sequence number within the CDP	O	O	M	*	
29-30	Trace identification code 1= seismic,2=dead, 3=dummy, 4=time break, 5=uphole, 6=sweep, 7=timeing, 8=water break, 9-32767 for optional use	M	M	M	M	
31-32	Number of vertically summed traces yielding this trace	O	O	O	O	5
33-34	Number of horizontally stacked traces. (spatial resampling factor)	M	M	M	M	6
35-36	Data use 1 = production data . 2 = test	M	M	M	M	
37-40	Distance from source point to receiver group	M	M	M	*	7



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Bytes	Description	Ident	Signal	Pre-Stack	Post stack	Notes
41-44	Receiver group elevation +ve above sea level, -ve below sea level	M	M	M	*	8,9
45-48	Source elevation	M	M	M	O	8,10
49-52	Source depth (positive number)	M	M	M	O	8,11
53-56	Datum elevation at receiver group	M	M	M	*	8
57-60	Datum elevation of source	M	M	M	O	8
61-64	Actual water depth at source	O	O	M	O	8,12
65-68	Actual water depth at group	O	O	O	*	8,13
69-70	Scalar to be applied to all elevations and depths -Always set to -100 = cm	M	M	M	M	14
71-72	Scalar to apply to all co-ordinates - Always set to -100 = cm	M	M	M	M	14
73-76	Source co-ordinate -X	M	M	M	O	14
77-80	Source co-ordinate - Y	M	M	M	O	14
81-84	Group co-ordinate - X	M	M	M	*	14
85-88	Group co-ordinate - Y	M	M	M	*	14
89-90	co-ordinate units 1 = length (meters or feet) 2 = seconds of arc	M	M	M	M	15
91-92	Weathering velocity	O	O	M	O	16
93-94	Sub-weathering velocity	O	O	M	O	16
95-96	uphole time at source	O	O	M	O	16
97-98	uphole time at group	O	O	O	*	16
99-100	Source static correction in milliseconds	O	O	M	*	17
101-102	Group static correction in milliseconds	O	O	M	O	17
103-104	Total static applied = sum of source and group residual statics (0 if not applied)	O	O	M	M	18
105-106	Pre NMO Residual static used for velocity computation	O	O	M	*	19
107-108	Datum static after NMO	O	O	M	*	20
109-110	Time of first sample in milliseconds	O	O	M	O	21
111-112	Mute time start (milliseconds)	M	M	M	M	22
113-114	Mute time end (milliseconds)	M	M	M	M	22
115-116	Number of samples in this trace	M	M	M	M	23
117-118	Sample interval of this trace in microseconds	M	M	M	M	
119-120	Gain type of field instruments	M	M	M	O	24
121-122	Instrument gain constant	M	M	M	O	24
123-124	Instrument initial gain	M	M	M	O	24
125-126	Correlated 1 = no 2=yes	M	M	M	*	25
127-128	Sweep frequency at start	M	M	M	O	25
129-130	Sweep frequency at end	M	M	M	O	25



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Bytes	Description	Ident	Signal	Pre-Stack	Post stack	Notes
131-132	Sweep length in ms.	M	M	M	O	25
133-134	Sweep type: 1=linear. 2=cos2 3=other	M	M	M	O	25
135-136	Sweep trace taper length at start ms.	M	M	M	O	25
137-138	Sweep trace taper length at end ms.	M	M	M	O	25
139-140	Taper type: linear. 2= parabolic. 3=exponential. 4=other	M	M	M	O	25
141-142	Alias filter frequency if used	O	O	O	O	26
143-144	Alias filter slope	O	O	O	O	26
145-146	Notch filter frequency (if used)	O	O	O	O	27
147-148	Notch filter slope	O	O	O	O	27
149-150	Low cut filter frequency (if used)	O	O	O	O	26
151-152	Low cut filter slope (if used)	O	O	O	O	26
153-154	High cut filter frequency (if used)	O	O	O	O	26
155-156	High cut filter slope (if used)	O	O	O	O	26
157-158	Year data recorded - from original field tape headers	M	M	M	M	28
159-160	Day of year – from original field tape headers	M	M	M	M	28
161-162	Hour of day (24 hour clock) - from original field tape headers	M	M	O	O	29
163-164	Minute of the hour- from original field tape headers	M	M	O	O	29
165-166	Second of the minute- from original field tape headers	M	M	O	O	29
167-168	Time basis (1 = local; 2 = GMT; 3 = other)	M	M	M	M	
169-170	Trace weighting factor - 2**-n volts for least significant bit	O	O	O	O	
171-172	Geophone group number of roll switch position 1	O	O	O	*	24, 30
173-174	geophone group number of trace number 1 within the original field record	O	O	O	*	24, 30
175-176	Geophone group number of last trace within the original field record	O	O	O	*	24, 30
177-178	Gap size (total number of groups dropped in centre shot spread)	O	O	O	O	24, 30
179-180	over travel associated with taper at beginning or end of line	O	O	O	O	24, 30
181-184	X co-ordinate of the bin-centre of the CDP in cm	M	M	M	M	31
185-188	Y co-ordinate of the bin-centre of the CDP in cm	M	M	M	M	31
189-192	In-line number	*	O	M	M	32
193-196	Cross Line number	*	O	M	M	32



Bytes	Description	Ident	Signal	Pre-Stack	Post stack	Notes
197-200	Shot point number (scaled)	M	M	M	O	33
201-202	Shot point scalar – convention as bytes 69-72	M	M	M	O	34
203-204	Sailed line number from pre-plot	M	M	M	O	
205-206	Reshoot counter – increment for split lines or re-shoots	M	M	M	O	
207-208	Sailed line sequence number	M	M	M	O	
209-210	Cable identifier as defined in SEG-D	M	M	M	O	
211-212	Source type (convention in EBCDIC header)	M	M	M	O	35
213-214	Receiver type as SEG-D revision 2 (and in EBCDIC header)	O	O	O	O	
215-216	The corrected gun mask	O	O	O	*	
217-218	Gun correction to MSL in milliseconds	O	O	O	O	
219-220	Cable correction to MSL in milliseconds	O	O	O	O	
221-222	Boat identifier (Convention in EBCDIC header)	O	O	O	O	
223-224	First break picking value (if applicable)	M				
225-226						
227-228	Actual Fold coverage	*	*	*	M	
229-230						
231-232						
233-234	CDP X in cm – actual co-ordinates	O	O	M	M	36
235-236	“					
237-238	CDP Y in cm – actual co-ordinates	O	O	M	M	36
239-240	“					

Notes: M = Mandatory

O = Optional

* = illegal - not valid for these data sets.

All integers are written in big-endian format i.e. the most significant byte (containing the sign bit) is written closest to the start of the file and the least significant byte is written closest to the end of the file.

1. The original SEG-Y standard specifies no more than one file on a tape and allows many tapes to be used for a line. This number is reset for each file when many SEG-Y files are written on a single tape. The standard is generally extended to allow multiple files on a single tape separated by file marks. In this case, the end of data condition is indicated by two consecutive file marks, this shall be seen by a user application as an empty file.
2. If the data has been re-sampled then this number should be the sequential trace number after resampling. – *not exactly as stated in the original SEG-Y format but more useful and easier to implement.*
3. Specify either the energy source point number if these are defined for this survey or the nearest actual shot point number. Post stack values should only be present at the CDP nearest to a shot point, these values are only relevant for 2D surveys



4. The CDP ensemble number (bytes 21-24) should be defined by the processing Contractor using their own convention. The CDP convention should be explained in the SEG-Y EBCDIC header.
5. This should reflect the spatial resampling factor rather than the number of traces that have been used to make a single trace to allow for spatial filtering as well as simple trace summation.
6. The CDP fold after stack (or partial stack).
7. The distance in meters between the source and receiver – negative if opposite to direction of line travel.
8. All elevations and depths are measured in cm – as defined in bytes 69-70
9. For marine data, this value should be the group depth.
10. The source elevation for marine data should be zero.
11. The source depth for marine data is the nominal depth of the source array.
12. This is normally recorded with the navigation data and should be available after the navigation merge.
13. The water depth at the group is not normally recorded and given the large horizontal offset of modern streamers it is unlikely that an accurate figure can be measured in the field. Any values calculated from the data should always be archived.
14. All elevations and co-ordinates are archived in cm.
15. The co-ordinate units should correspond to a length (either meter or feet).
16. These values are optional – water velocity for marine data can be saved as the weathering velocity.
17. The source and receiver static values are the total including residual for the source and receiver.
18. The total static applied may include residuals calculated for individual traces.
19. This assumes that a floating datum is used for NMO estimation and application.
20. The datum static is then applied after NMO to correct each CDP to the standard datum.
21. A negative time for the first sample indicates that there is data above the datum level – e.g. land data processed to a mean sea level datum.
22. The SEG-Y format only covers first break mutes, these are applied as either a linear taper or a ramp function (possibly cosine squared) of a known length. The mute start time is the time in milliseconds of the first non-zero sample. The mute end time is the time of the first sample that has not been tapered by the mute. The stack scaling factor calculated for the mute zone needs to know how the data has been scaled for each trace used to form an output sample. This is very easy for linear scaling and only slightly more complex for cosine tapers.
23. SEG-Y allows variable length traces to be written.
24. These fields are not normally used for modern data – they may be redefined if additional residual statics fields are these are useful.
25. The Vibroseis® details should be archived for land data.



26. The filter details should be archived if available. The high and low cut filters values include any filters applied in processing.
27. Any notch filters applied must be archived.
28. The minimum day and year of the traces used to form the output trace should be recorded.
For full 3D migrations, this may be the start date for the entire survey.
29. The hour, minute and second values are meaningless after stack or migration.
30. These values are only relevant for 2D land data.
31. Use the actual mid-point prior to 3D CDP binning.
32. In-line and cross line conventions should be detailed in the EBCDIC header and the accompanying documentation.
33. Required for 2D data
34. The scalar to be applied to the shot point number in 197-200 to give the real shot point value. If positive the scalar is used as a multiplier, if negative as a divisor, if zero the shot point number is not scaled i.e. it is an integer. A typical value of -10 allows shot points to be specified to one decimal place.
35. The source type flag can be used to indicate port or starboard arrays, different groups of vibrators etc.
36. The actual CDP co-ordinates are the midpoint pre-stack or the bin centroid post stack. These processing Contractors should estimate any effects of pre-stack imaging on the values entered in these fields.

5.6 Polarity convention

SEG polarity conventions differ for minimum phase and zero phase seismic data.

For minimum phase data, "normal" polarity is defined as:

COMPRESSION = NEGATIVE NUMBER = ONSET OF WHITE TROUGH

For zero-phase data, positive standard polarity is defined as:

COMPRESSION = POSITIVE NUMBER = CENTRE OF BLACK PEAK

Contractor must avoid the use of terms such as "normal SEG" or "reverse SEG" which are ambiguous.

6. Appendix 2: Velocity and anisotropy files format

Company requests Vrms velocities and non-hyperbolic parameters used for **migration** and **stacking** as defined below.

Full PSTM migration velocities:

1. Vrms migration velocities in ESSOV2 format (see details below).
2. Non-hyperbolic migration parameter as specified below in ESSOV2 format.

Definition of the non-hyperbolic move out parameter:

The Company requests the non-hyperbolic move out parameter expressed as $1000/S$ where S is the shift parameter as defined by Castle, 1994, A theory of normal move out: Geophysics, 59, No. 6, 983-999.



Definition of S for **isotropic** layers:

$$S = \frac{V_4^4}{V_{rms}^4}; \quad V_{rms} = \sqrt{\frac{\sum_k t_k v_k^2}{\sum_k t_k}}; \quad V_4^4 = \frac{\sum_k t_k v_k^4}{\sum_k t_k}$$

Definition of S for **anisotropic** layers:

Compute effective η and convert to S using the relationship

$$S = 1 + 8\eta \quad (1)$$

The values in the ESSOV2 file must be $\frac{1000}{S}$.

Stacking velocities:

1. Stacking velocities in ESSOV2 format.
2. Non-hyperbolic stacking parameter expressed as $1000/S$ where S is Castle's shift parameter in ESSOV2 format. Effective η must be converted to S with equation (1).

The values in the ESSOV2 file must be $\frac{1000}{S}$.

7. Appendix 3: Glossary

AVO:	Amplitude Versus Offset
CMP:	Common Mid Point (between source centre and a trace centre)
CDP:	Common Depth Point
DBS:	Deconvolution Before Stack
DMO:	Dip Move Out
EOF:	End Of File
EOL:	End Of Line
OBC	Ocean Bottom Cable
OBP:	On Board Processing
PSDM:	Pre Stack Depth Migration
PSTM:	Pre Stack Time Migration
QC:	Quality Control



Quality Audit	A systematic and independent examination to determine whether Quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives
Quality Manual:	A document stating the Quality Policy, and describing the quality system of an organization
Quality Project Plan:	Document setting out the specific Quality practices, resources and sequence of activities relevant to the particular project
RMS:	Root Mean Square
SNR or S/N:	Signal to Noise Ratio
SOL:	Start Of line
SP:	Shot point
TVF/TVS:	Time Variant Filtering / Time Variant Scaling
VP:	Vibrating Point
VSP	Vertical Seismic Profile

8. Appendix 4: Standard Processing Sequence

Step number	Step description	STANDARD PROCESSING SEQUENCE
Stage 1.Reformatting / Editing / De-spiking / Geometry		
1)	Demultiplexing and reformatting to contractor internal format	Yes
2)	Seismic / Navigation merge	Yes
3)	Amplitude / Phase / Time delay / Trace Edition QCs	Yes
4)		
5)	Zero phase low cut filter	Yes
6)	Spherical divergence (TV ²) compensation including offset term	Yes
7)	FK or linear Tau-P filter in SP and/or receiver domain	Yes
8)	FX Projective Swell noise attenuation (shot and/or receiver domain)	Yes
9)	Q Compensation (Phase only)	Yes
10)	Foot print compensation in amplitude and time	Yes
11)	Pre-stack predictive deconvolution in T-X or Tau-P domain with zerophase output	Yes
Stage 2. Velocity Analyses / Demultiple		
12)	3D Preliminary velocity analysis every 1km * 1 km	Yes
13)	High Resolution Demultiple in the Radon Tau-P domain (1 st pass)	Yes



Step number	Step description	STANDARD PROCESSING SEQUENCE
14)	Diffacted Multiple attenuation	No
15)	Surface consistent amplitude correction	Yes
16)	Fold normalization and missing trace interpolation	Yes
17)	Bin centering	Yes
18)	Trim statics	Yes
19)	De-absorption compensation in amplitude time-space variant	Yes
20)	<i>Tape output of gathers pre-PSTM in SEG Y format</i>	Yes
Stage 3. Velocity Analyses PSTM / Stack		
21)	Full, pre-stack anisotropic Kirchhoff time migration. All iterations of migration, work on data and velocity picking due to the application of the full pre-stack time migration are included in the sequence price. Anisotropic KIRCHHOFF Ray Bending – 3 km half operator, 11 velocity perturbations, one velocity line/500 m	Yes
22)	High Density, 2 nd & 4 th order residual NMO velocity analysis for every CMP	Yes
23)	High Res. Demultiple in the Radon Tau-P domain (2 nd pass)	Yes
24)	Geostatistical QC of the velocity field	Yes
25)	<i>Tape output of PSTM Gathers in SEG Y format (without NMO)</i>	Yes
26)	Mute (internal and external)	Yes
27)	Angles (or offset) sub-stacks (2 cubes)	Yes
28)	Stack full offset	Yes
Stage 4. Post-stack processing (for full stack and sub-stacks)		
29)	FX cross-line trace interpolation 12.5m to 6.25 m	Yes
30)	Source and cable static	Yes
31)	<i>Tape output of the raw migrated data in SEG Y format</i>	Yes
32)	3D Random noise attenuation	Yes
33)	Spectral whitening or widening	Yes
34)	Residual zero-phase correction (from well matching)	Yes
35)	Time Variant Filtering	Yes
36)	Residual amplitude correction	Yes



Step number	Step description	STANDARD PROCESSING SEQUENCE
37)	<i>Tape output of the final migrated data in SEG Y(as per ...) and stacking velocity field Vrms and S libraries (as per APPENDIX 2) in ESSO V2.</i>	Yes
38)	<i>Final report</i>	Yes

9. Appendix 5: ESSOv2 layout

9.1 Description

Comments lines beginning with H must contain the following information:

CLIENT, AREA, DATA, GEODESY, VELOCITY ORIGIN, VELOCITY/TIME UNITS

The elevation of Velocity origin (Floating datum elevation for onshore, MSL=0 for offshore) must be added.



Exploration & Production

General Specification

Date : 01/2012

GS EP GIN 122

Rev : 00

Col	Length	Bytes	Format	Value	Description	Comments
1	2	1- 2	AlphaNum	V2	` V2 ' code	Always
3	5	3-7	AlphaNum		Area (left justified)	Default:31685
8	8	8-15	AlphaNum		Line Number(left justified)	
16	5	16-20	I5		Shot Point Number/CMP Number (right justified)	
21	1	21	AlphaNum		Reshot code	Default:O
22	4	22-25	AlphaNum		Contractor Code following Archiv code	Default:PBAD
26	4	26-29	AlphaNum		Data Type following Archiv code	Default:STCK
30	4	30-35	Num		Date of interpretation (YYMMDD)	Default: blank
36	5	36-40	I5		Two-way Time in ms (right justified)	
41	8	41-48			Spaces	
49	1	49	AlphaNum		Velocity Unit (m/s=0, ft/s=1)	Default: blank
50	7	50-57			Spaces	
57	5	57-61	I5		Velocity	
62	10	62-71	F10.0		X coordinate Geodesy information in the header	
72	10	72-81	F10.0		Y coordinate Geodesy information in the header	



9.2 Example

Extracted from a ESSOV2 file part of a 3D onshore processing

0-----1-----2-----3-----4-----5-----6-----7-----
--8

1---+---0---+---0---+---0---+---0---+---0---+---0---+---0---+---
--0

H01

H01 CLIENT : TOTAL E & P XXXX

H02 AREA : XX199

H03 DATA : PRE-STACK TIME MIGRATION VELOCITIES

H04

H05 SPHEROID: XXXXXX1909 INTERNATIONAL 2024, DATUM: XX-50

H06 PROJECTION: TYPE: XXX - ZONE: 99DEG; XXXXX 92DEG E,

H07 CENTRAL MERIDIAN 92DEG E

H08 LAT/LON ORIGIN 0/12DEG FALSE EAST 9999999M,

H09 FALSE NORTH 0M, SCALE FACTOR 0.9996

H10

H11

V2191 3401 4601xxxxA 042408 96 1 2176 406250.
2786954.

V2191 3401 4601xxxxA 042408 192 1 2304

V2191 3401 4601xxxxA 042408 288 1 2496

V2191 3401 4601xxxxA 042408 384 1 2656

V2191 3401 4641xxxxA 042408 96 1 2176 406121.
2786471.