



Cboe Compression Service User Manual

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1 Overview

The Cboe Compression Service (CCS) is used by TPHs to manage capital requirements associated with portfolios of index options positions. The CCS is a compression service that provides match data file functionality of the legacy Compression Forum Manager (CFM) and sets the stage for more advanced multilateral compression services to be delivered in the future.

The first section of this document – Match Data Service - presents the input file format specification required to submit positions to the CCS to participate in the match data service. At the end of a position submission window, match data files are generated for multiple structures that provide TPHs with information regarding contra TPHs that have offsetting positions. TPHs use the match data files to manually consummate bilateral Position Compression Cross (PCC) trades, or to execute compression trades in open outcry. The format of the output files generated by the match data service is presented in the Match Data Service section below.

The second section of this document – Multilateral Compression Service – presents an overview of file format features that will be used in a future CCS release introducing multilateral compression. These features allow TPHs to specify cost constraints, risk exposure constraints, and compression regulatory capital measures that provide fine-grained control in specifying the attributes of compression portfolios acceptable to participating TPHs. Input files submitted to the current CCS (match data service) will work as-is for the multilateral compression enabled service of the future. That said, when using the future multilateral compression service, TPHs will generally use the additional features of the input file specification to more precisely control and constrain the allocation of trades based on business objectives and risk management practices.

When multilateral compression is introduced in future releases of the CCS, the match data service functionality will continue to be available to those TPHs that opt-in to receiving match data files, and no input file format changes will be required.

2 Cboe Compression Service Access

To gain access to the Cboe Compression Service, TPHs should contact [Membership Services](#). Membership Services will provide instruction on gaining access to the service, after which authorized individuals from the firm will be able to access CCS in the Cboe Exchange certification environment. TPHs then execute a certification process that must be completed prior to being granted access the CCS in the production Cboe Exchange environment (described below).

The current release of the CCS provides functionality for firms to upload position files during the submission window, and to download match files at the end of the submission window after match files have been generated. A future release of the CCS, preceded by a Trade Desk notice, will introduce an extended workflow incorporating multilateral compression. The workflow extensions and interface for the multilateral compression functionality will be detailed in future updates of this User Manual.

TPHs that register to use the CCS match data service are required to complete a certification process prior to using the service in the production Cboe Exchange environment. Certification is accomplished by interacting with the service in the Cboe Exchange certification environment, under the direction of the Cboe Trade Desk, to demonstrate the ability to construct properly formed input files, and the ability to download and interpret match

files. After successful certification, TPHs will be able to access CCS via the firm portal login in the production Cboe Exchange environment.

The certification process must be completed by at least one authorized firm login. Certification does not require that all registered firm logins complete the certification process. It is assumed that knowledge is distributed across authorized firm logins. It is further assumed that systems used to generate inputs to the CCS are generally automated, and once demonstrated compatible with the service, they will remain so. TPHs are advised to contact the Trade Desk to test major firm-side input file generation changes in the Cboe Exchange certification environment.

3 Match Data Service

The current release of the CCS provides match data service only to TPHs. The input file format, specified below, is used to submit positions to the current match data service.

Input files complying with the file format specified below will work without change in future releases of the CCS that introduce multilateral compression. In future releases, TPHs will be able to opt-in to match data service and/or multilateral compression when uploading files. TPHs that wish to participate in match data service only will be able to use current CCS input files unchanged. TPHs that wish to participate in multilateral compression will use additional features of the file format that will be specified in future releases of this user manual.

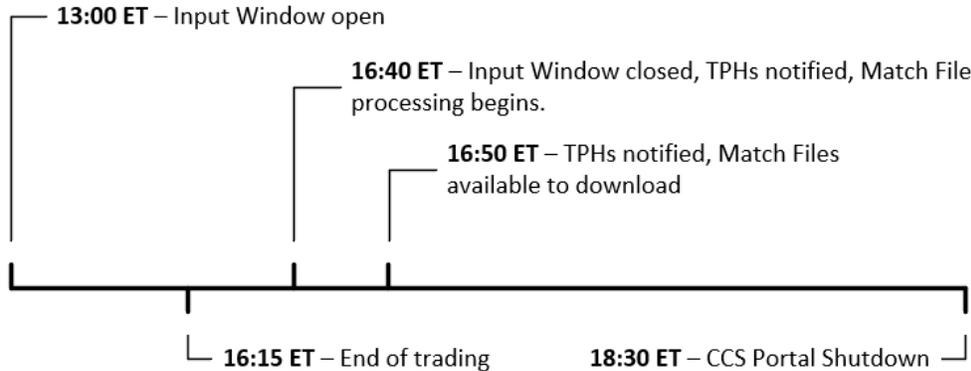
To use the match data service, TPHs access the Cboe Compression Service application in the firm portal during the submission window on a normal trading day. Normal trading days are non-holiday dates and exclude partial trading days resulting from holiday trading hours¹. The start and end times of the submission window are presented in the Intraday Service Timeline section below. While the submission window is open, TPHs can upload input files, cancel submissions, and re-upload input files. At the end of the submission window, participating TPHs are notified via email that the submission window has closed, and if more than one TPH has submitted input position files, the service generates match files that are downloaded by TPHs through the same CCS portal application through which input files were submitted. TPHs are notified via email when match files are available to be retrieved via the CCS portal application. Match files are available for TPH download until the shutdown time of the CCS portal.

¹ Cboe reserves the right to limit dates on which match data service is available in order to better consolidate participating on dates that the participating TPH community generally agrees are preferred compression dates.

3.1 Intraday Service Timeline

Figure 1 below presents the intraday timeline of the match data service.

Figure 1 - Intraday timeline of match data file service



3.2 Input File Specification

The following input file specification enables TPHs to use the CCS to receive match files as specified in the Output File Specification section of this document. Further, the same input format files specified herein can be used in future releases of the service without change when using match data service only.

CCS input files are comma separated value (CSV) formatted files. The first three rows of the input file must contain values as presented in Figure 2 below (with the exception of the zeros, which can be any floating point number as they are ignored by the current release of the CCS). Embedded whitespace at the beginning, end, or within a row is not allowed, embedded commas are not allowed, and double quote delimited values containing embedded commas are not allowed and will cause an input file upload to be rejected.

Figure 2 - First three lines of a match information service input file

```
class,expiry,strike,put_call,qty,theo,close_benefit,reserved,reserved,cost,cost_benefit
,,,,,,,,,
,,,,,,,,,0.0,0.0
```

The first row is the header row containing descriptive names of each positional value. Note the header line token values are not validated – only the number of tokens is significant. The second and third row values are ignored but will be used in future releases of the system to specify minimum and maximum values of certain constraints in the multilateral compression. The two zero values shown in the third row can contain any non-negative numeric value as they are ignored by the match data service, but for simplicity 0.0 can be used. Rows four and higher (one-referenced) each represent a position in an option series that the TPH is submitting to the CCS. The format and content of each position row field is presented in Table 1 below.

Table 1 - Option position row field definition

Field	Description
class	Case sensitive SPX or SPXW
expiry	Expiration date in YYYY-MM-DD format
strike	Option price as a floating point numeric value, which corresponds to a valid listed strike price of the class and expiration.
put_call	Case sensitive P or C
qty	Signed integer contract position where positive integer is a long position and negative integer is a short position. Zero values are accepted but are discouraged as they are ignored for match data file generation.
theo	Floating point value representing the TPH assessment of the theoretical value of one long contract of the associated option (i.e., contract multiplier of 100 applied). This value is not used for the match data file service and zeros are acceptable.
close_benefit	Non-negative floating point value representing the TPH assessment of the regulatory capital requirements benefit resulting from reduction of the position by a single contract (long or short). This value is not used for the match data file service and zeros are acceptable.
reserved	Must be null (i.e., consecutive commas)
reserved	Must be null (i.e., consecutive commas)
cost	Must be null (i.e., consecutive commas)
cost_benefit	Must be null (i.e., newline immediately after preceding comma)

Figure 3 below presents an example of a complete input file including the formatted first three rows and several options positions. Note the ellipsis at the end of the example below is not part of the file and is used to represent continuation of additional option position rows. In practice, input file submissions can contain thousands of position rows on 30 or more distinct class expirations.

Figure 3 - Example CCS 1.0 position input file

```
class,expiry,strike,put_call,qty,theo,close_benefit,reserved,reserved,cost,cost_benefit
,,,,,,,,,
,,,,,,,,,0.0,0.0
SPXW,2021-05-28,4175.0,C,22,0.0,0.0,,,,,
SPXW,2021-05-28,4200.0,C,42,0.0,0.0,,,,,
SPXW,2021-05-28,4300.0,C,50,0.0,0.0,,,,,
SPXW,2021-05-28,4900.0,C,-100,0.0,0.0,,,,,
SPXW,2021-05-28,5200.0,C,-20,0.0,0.0,,,,,
SPX,2021-06-18,100.0,C,25,0.0,0.0,,,,,
SPX,2021-06-18,100.0,P,-100,0.0,0.0,,,,,
SPX,2021-06-18,200.0,C,-20,0.0,0.0,,,,,
SPX,2021-06-18,200.0,P,-50,0.0,0.0,,,,,
SPX,2021-06-18,300.0,P,250,0.0,0.0,,,,,
...
```

3.3 Input File Validation

When TPHs upload files through the CCS application in the firm portal, strict validation checks are applied to confirm compliance with all requirements of the input file specification below. For example, expiration dates are required to be provided in YYYY-MM-DD format. A single expiration date among thousands specified in an incorrect format, or representing an invalid date, will cause the upload to fail. The same is true of all other input file validation errors. TPHs are presented with detailed error messages describing all validation errors contained in an upload (not just the first validation error) facilitating a straightforward process to update the file and re-upload.

- Invalid expiry date format (e.g., MM/DD/YYYY specified rather than the required YYYY-MM-DD). This is the most common formatting error as input CSV files opened and saved in Excel will convert dates formatted YYYY-MM-DD to MM/DD/YYYY automatically.
- Wrong number of tokens in the header row
- Incorrectly formatted second or third row - typically one too many or one too few consecutive commas
- Invalid class value - only SPX or SPXW are supported
- Expired options - expiration dates on current or prior date are not allowed
- Invalid or non-listed strike price - only currently listed strikes are supported
- Null value (consecutive commas) provided where non-null values are required, or vice versa
- Leading, trailing or embedded whitespace
- Commas embedded in integer values
- Double-quotes output by some systems to escape values containing commas are not supported

3.4 Output File Specification

At the end of the input submission window, match data files are computed and made available to all participating TPHs through the CCS application in the firm portal. If only one TPH uploads a file, that TPH will receive a courtesy email notifying that no match data files will be disseminated.

When two or more TPHs submit input files for match data service, four match files containing details on contra TPHs with which they can cross the following structure positions are disseminated to all participating TPHs:

- Outright match file containing all possible outright option crossings
- Spread match file containing all possible put spread and call spread crossings
- Combo match file containing all possible combo crossings (synthetic long and short positions)
- Box spread match file containing all possible box spread crossings

The following sections present the format of each of the four match file types. Like input files, match files are comma separated value formatted files. In each of the file format specifications, the first field (*option_id*) is an opaque identifier for each match structure within the associated match file. Note that an *option_id* value may appear multiple times in a file if the identical structure can be crossed with multiple contra TPHs. The combination of *option_id* and *tph_2* will be unique in each file. TPHs should not attempt to parse *option_id* as Cboe reserves the right to change the definition of the *option_id* value.

3.4.1 Outright Match File Format

Table 2 presents the definition and format of the fields of the outright match file. The values in the Field column are exactly the values contained in the header row for the associated field.

Table 2 - Outright match file field definition

Field	Description
option_id	Opaque unique identifier for the outright match associated with the row
class	SPX or SPXW
expiry	Expiration date in YYYY-MM-DD format
strike	Strike price as floating point numeric value
put_call	P or C
tph_1	TPH firm identifier
tph_2	Firm identifier of the contra TPH
tph_1_size	Outright position size in TPH submission where positive is long and negative is short.
compress_qty	Unsigned crossing quantity possible between TPH and contract TPH. By definition, the contra TPH position is the opposite sign of the TPH position, and the compress_qty is the minimum of the TPH and contra TPH absolute size.

Figure 4 below is an example of the outright match file format.

Figure 4 - Example outright match file

```
option_id,class,expiry,strike,put_call,tph_1,tph_2,tph_1_size,compress_qty
SPXW202012243700C,SPXW,2020-12-24,3700,C,TPH1,TPH2,100,20
SPXW202012243700C,SPXW,2020-12-24,3700,C,TPH1,TPH3,100,50
SPXW202012243700P,SPXW,2020-12-24,3700,P,TPH1,TPH2,-100,20
SPXW202012243700P,SPXW,2020-12-24,3700,P,TPH1,TPH3,-100,50
SPXW202012243800C,SPXW,2020-12-24,3800,C,TPH1,TPH2,-100,20
SPXW202012243800C,SPXW,2020-12-24,3800,C,TPH1,TPH3,-100,50
SPXW202012243800P,SPXW,2020-12-24,3800,P,TPH1,TPH2,100,20
SPXW202012243800P,SPXW,2020-12-24,3800,P,TPH1,TPH3,100,50
...
```

3.4.2 Spread Match File Format

Table 3 presents the definition and format of the fields of the spread match file. The values in the Field column are exactly the values contained in the header row for the associated field.

Table 3 - Spread match file field definition

Field	Description
option_id	Opaque unique identifier for the spread match associated with the row
class	SPX or SPXW
expiry	Expiration date in YYYY-MM-DD format
strike_1	Lower strike price of the spread (always < strike_2)
strike_2	Upper strike price of the spread (always > strike_1)
put_call	P or C. P indicates Put Spread and C indicates Call Spread
tph_1	TPH firm identifier
tph_2	Firm identifier of the contra TPH

tph_1_size	Size of the spread position contained in TPH submission. Positive value indicates long strike_1 and short strike_2. Negative value indicates short strike_1 and long strike_2. The magnitude of the value will be the minimum of the TPH absolute position on strike_1 and strike_2 as spreads are defined as equal and opposite size on each leg.
compress_qty	Unsigned crossing quantity possible between TPH and contract TPH in the spread position. By definition the contra TPH position is opposite sign of the TPH position and the compress_qty is the minimum of the TPH and contra TPH absolute size.

Figure 5 below is an of the spread match file format.

Figure 5 - Example spread match file

```
option_id,,class,expiry,strike_1,strike_2,put_call,tph_1,tph_2,tph_1_size,compress_qty
SPXW202012243700CSPXW202012243800C,SPXW,2020-12-24,3700,3800,C,TPH1,TPH2,100,20
SPXW202012243700CSPXW202012243800C,SPXW,2020-12-24,3700,3800,C,TPH1,TPH3,100,50
SPXW202012243700PSPXW202012243800P,SPXW,2020-12-24,3700,3800,C,TPH1,TPH2,-100,20
SPXW202012243700PSPXW202012243800P,SPXW,2020-12-24,3700,3800,C,TPH1,TPH3,-100,50
...
```

3.4.3 Combo Match File Format

Table 4 presents the definition and format of the fields of the combo match file. The values in the Field column are exactly the values contained in the header row for the associated field.

Table 4 - Combo match file field definition

Field	Description
option_id	Opaque unique identifier for the combo match associated with the row
class	SPX or SPXW
expiry	Expiration date in YYYY-MM-DD format
strike	Lower strike price of the combo
tph_1	TPH firm identifier
tph_2	Firm identifier of the contra TPH
tph_1_size	Size of the combo position contained in TPH submission. Positive value indicates long call and short put on the strike (i.e., synthetic long). Negative value indicates short call and long put (i.e., synthetic shot). The magnitude of the value will be the minimum of the TPH absolute position on put and call as combos are defined as equal and opposite size on the put and call at same strike.
compress_qty	Unsigned crossing quantity possible between TPH and contract TPH in the combo position. By definition the contra TPH position is opposite sign of the TPH position and the compress_qty is the minimum of the TPH and contra TPH absolute size.

Figure 6 below is an example of the combo match file format.

Figure 6 - Example combo match file

```
option_id,class,expiry,strike,tph_1,tph_2,tph_1_size,compress_qty
SPXW202012243700CSPXW202012243700P,SPXW,2020-12-24,3700,TPH1,TPH2,100,20
SPXW202012243700CSPXW202012243700P,SPXW,2020-12-24,3700,TPH1,TPH3,100,50
SPXW202012243800CSPXW202012243800P,SPXW,2020-12-24,3800,TPH1,TPH2,100,20
SPXW202012243800CSPXW202012243800P,SPXW,2020-12-24,3800,TPH1,TPH3,100,50
...
```

3.4.4 Box Spread File Format

Table 5 presents the definition and format of the fields of the box spread match file. The values in the Field column are exactly the values contained in the header row for the associated field.

Table 5 - Box spread match file field definition

Field	Description
option_id	Opaque unique identifier for the box spread match associated with the row
class	SPX or SPXW
expiry	Expiration date in YYYY-MM-DD format
strike_1	Lower strike price of the box spread
strike_2	Upper strike price of the box spread
tph_1	TPH firm identifier
tph_2	Firm identifier of the contra TPH
tph_1_size	Size of the box spread position contained in TPH submission. Positive value indicates long call and short put on strike_1, and short call and long put on strike_2. Negative value indicates short call and long put on strike_1, and long call and short put on the strike_2. The magnitude of the value will be the minimum of the TPH absolute position on all four legs box spreads are defined as equal absolute size on all four legs.
compress_qty	Unsigned crossing quantity possible between TPH and contract TPH in the combo position. By definition the contra TPH position is opposite sign of the TPH position and the compress_qty is the minimum of the TPH and contra TPH absolute size.

Figure 7 below is an example of the box spread match file format.

Figure 7 - Example box spread match file

```
option_id,class,expiry,strike_1,strike_2,tph_1,tph_2,tph_1_size,compress_qty
SPXW202012243700CSPXW202012243700PSPXW202012243800CSPXW202012243800P,SPXW,2020-12-24,3700,3800,TPH1,TPH2,100,20
SPXW202012243700CSPXW202012243700PSPXW202012243800CSPXW202012243800P,SPXW,2020-12-24,3700,3800,TPH1,TPH3,100,50
...
```

4 Multilateral Compression Service

The current CCS provides TPHs with match data files that they use to bilaterally execute PCC transactions or compression trades in open outcry. A future release of the CCS will introduce multilateral compression. TPHs will enhance their input position files with information that expresses their goals and constraints for multilateral compression. The system uses this information to compute a portfolio of multilateral compression trades between participating TPHs that simultaneously satisfies all participating TPH cost and risk constraints while delivering maximum benefit to all TPHs. A compression portfolio candidate will be presented to each TPH in a modified workflow on the CCS portal that provides TPHs the opportunity to accept or reject the candidate compression portfolio. Upon unanimous acceptance by all participating TPHs, the trades comprising the compression portfolio will be processed by the trading system, cleared at the OCC using clearing details provided by the TPH at the time of CCS registration, printed to OPRA, and are represented on depth and top of book data feeds as trade messages.

In future multilateral compression enabled releases of the CCS, the match data service functionality will continue to be provided on an opt-in basis using post-compression positions. In other words, following a successful compression, TPHs that have opted-in for match data file service will receive match files computed using the post-compression residual positions. In this regard, future releases of the CCS are a hybrid multilateral and bilateral service.

Future updates to this document will provide complete information on the workflow and process for hybrid multilateral-bilateral compression. Input file format specification for extended features of the input file format specification used for TPH-defined cost and risk constraints and compression objectives will be detailed. The introductory information below provides an overview of features of the input file format specification will enable fine-grained control over attributes of their allocated portions of multilateral compression portfolios, and the manner in which the details of a compression portfolio will be presented to TPHs for analysis and acceptance.

4.1 Input File Specification

Future CCS releases that introduce multilateral compression will use the same input file format as specified above for the match data service functionality. TPHs that wish to continue using match data services only can do so with no change to their input files. TPHs that wish to participate in multilateral compression will use features of the input file format to express cost and risk constraints and compression objectives.

4.1.1 Constraint Minimum and Maximum Specification

The input file specification presented in the Match Data Service section above specifies that the values in the second and third lines are ignored, which remains true for TPHs that intend to opt-in to match data services only. TPHs that participate in multilateral compression will use the second row to specify minimum values for TPH-defined custom constraints and the third row to specify maximum values for TPH-defined custom constraints (described below). Further, tokens 10 and 11 of the third row presented above (that are ignored in the match data service) are used to specify the maximum cost and maximum cost per unit of benefit they are willing to accept in a compression portfolio.

4.1.2 Cost Constraints

In order to enable the system to compute the mark to market cost of a compression portfolio, TPHs will provide their assessment value of one contract (i.e., contract multiplier weighted) of the associated option in the *theo* column. The traded contract weighted difference between the TPH-provided *theo* value and the compression price provided by the Exchange for each option is the cost of each trade in a compression portfolio. The sum of the cost of trades is the total cost of the compression portfolio to the TPH.

4.1.3 Per-Option Benefit and Cost Per Unit Benefit Constraints

The *close_benefit* column of the input file specification, which is ignored by match data service, is used by TPHs to provide their non-negative measure of regulatory capital benefit associated with closing one contract of the associated option long or short position. The sum of the absolute traded contract weighted *close_benefit* values over all trades in a candidate compression portfolio is the total benefit of the compression portfolio. This value is the denominator of the cost per unit benefit for which the TPH can specify a maximum value.

4.1.4 Custom Constraints

TPHs require unrestricted ability to specify custom constraints on the portfolios of compression trades they are willing to accept in a compression portfolio. The Exchange has chosen not to prescribe a single set of constraints that TPHs can use, but instead has designed a generalized unit-agnostic framework that allows TPHs to design and specify a custom constraint regimen that fits their business goals. This is the purpose of introducing the second and third rows of the input file – to specify minimum and maximum values, respectively, for each TPH-defined custom constraint. To define a custom constraint, TPHs add a column to the input file with an unique label in the first row that identifies each constraint, the minimum value for the constraint in the second row, the maximum value for the constraint in the third row, and signed floating point values for every option position row that represents the contribution to the constraint of executing one long contract in the option. Zero values are specified for options that don't contribute to a particular custom constraint. The sum of the signed traded quantity weighted constraint values is the aggregate constraint value that will not exceed TPH-specified minimum and maximum values for the constraint.

Using this mechanism, TPHs can specify compression portfolio-level custom risk constraints by providing non-zero constraint values for each option regardless of expiry or class. TPHs can specify expiration-specific constraints (e.g., greeks by expiration), by expiration and strike/delta bucket, etc. by selectively specifying zero values for a custom constraint. There is effectively no limit to the nature and granularity of constraints TPHs can specify to express the attributes of compression portfolios they are willing to accept in the multilateral compression process.

4.2 Output File Specification

When a multilateral compression portfolio is computed by the CCS, it is presented to all participating TPHs in a form and manner that allows them to analyze the details of all trades in the compression portfolio in which they are a party, confirm that their prescribed cost and risk constraints are satisfied, and to generally assess the quality of the compression portfolio against their business objectives. To facilitate this process, TPHs are provided with a trade and detail output files containing details of their participation in the compression portfolio.

The trade output file is a simple trade blotter presenting essential details of the trades in the compression portfolio in which the TPH is a party.

The detail output file is a decorated version of the submitted input file that contains complete details of all constraint calculations. Using the detail output file, TPHs can replicate all cost and risk constraints to confirm that their specified constraints are satisfied, as well as more in-depth analysis of the structure and content of the portfolio, such as identifying which constraints are most influential, constraints that may be over or under specified, etc.

Using the trade and detail output files, TPHs have the information they need to determine whether they accept or reject the compression portfolio. A goal of the multilateral service design is to provide sufficient flexibility and granularity to enable TPHs to express the attributes of compression portfolios at a resolution needed so that portfolio acceptance will be the norm.

Revision History

Version	Date	Description
1.0.0	02/05/21	Initial revision covering CCS 1.0 match file functionality with only general introduction to future multilateral compression functionality, which will be presented in detail in future releases of this document.
1.0.1	04/29/21	Changed references to future-use fields 'open_buy_penalty' and 'open_sell_penalty' to 'reserved' as the definition. Name and use of these fields may change prior to their use in future releases of the CCS service. Added invalid expiration date format to the top of the common input file validation errors.
1.0.2	05/03/2021	Removed references to legacy Compression Forum Manager (CFM) migration as the service migration to CCS is complete. Added registration and certification process content. Added intraday timeline details.