A2 - Database

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1. General Definitions

1.1 Identification of Materials

For the definite identification of materials, following keys are used:

char(7)	slabId	slab identification
long	pasNo	RM pass number
long	seqNo	sequence number
long	standNo	FM stand number

1.2 Dimensions of Materials

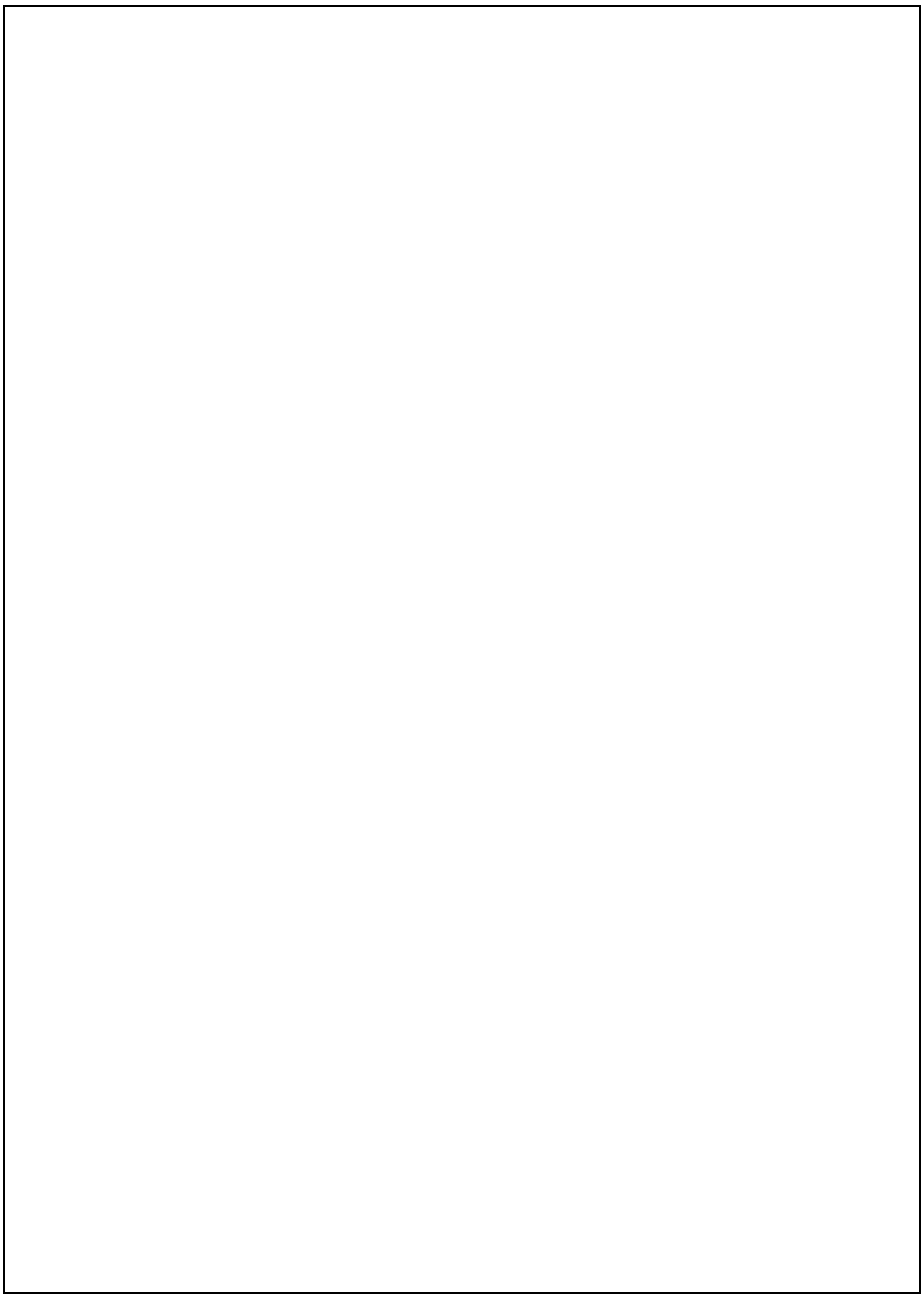
All dimensions, referenced later on in this document, not explicitly specified as *hot* are related to *cold* material.

Explanation of terms *cold* / *hot*:

cold	room temperature
hot	actual or estimated production temperature

2. Description of Database

2.1 Data Tables Relationship



2.2 Constants

```
                                        /* function return codes               */
                                        /* ----------------------------------- */
#define MDB_dNormal           1         /* normal successful completion        */
#define MDB_dExist            1         /* normal successful completion        */
#define MDB_dNotExist      1002         /* DB record not existing              */
#define MDB_dMarkDelete    1003         /* DB marked for delete                */

#define MDB_dError            0         /* unspecified error                   */
#define MDB_dInvRecNam    -1001         /* invalid DB record name              */
#define MDB_dInvItem      -1002         /* invalid DB item or item undefined   */
#define MDB_dInsfArgList  -1003         /* insufficient argument list          */
#define MDB_dNoSlotFree   -1004         /* no slots free                       */


#define MDB_dMMIError     -1004         /* MMI local use error                 */

                                        /* definitions, used in structures     */
                                        /* ----------------------------------- */
#define MDB_dSouth            0         /*  south                              */
#define MDB_dNorth            1         /*  north                              */
#define MDB_dCenter           0         /*  center                             */
#define MDB_dOperSide         0         /*  operator side                      */
#define MDB_dDriveSide        1         /*  drive side                         */
#define MDB_dStretchAct       0         /*  actual stretch data                */
#define MDB_dStretchMea       1         /*  measured/previous stretch data     */

                                        /* limit definitions                   */
                                        /* ----------------------------------- */
#define MDB_dNoAnaElements   50         /* number of analysis elements         */
#define MDB_dMaxPasRM         9         /* max number of passes in RM          */
#define MDB_dNoStand          6         /* Number of stands in FM              */
#define MDB_dNoSlize         60         /* maximum points for work rool barrel */
                                        /* length decomposition                */
#define MDB_dNoStretchRec     2         /* no. of stretch data records         */

#define MDB_dMinRecipeNo      1         /* recipe number minimum               */
#define MDB_dMaxRecipeNo   9999         /* recipe number maximum               */
#define MDB_dMaxStretchSetp  40         /* max no. of points in stretch curve  */

#define MDB_dMaxSteelGrade    200       /* steel grade references maximum      */
#define MDB_dMaxStratCool     200       /* strategy cooling maximum            */
#define MDB_dMaxStratDesc      50       /* strategy descaling maximum          */
#define MDB_dMaxStratLoop     900       /* looper strategy maximum             */
#define MDB_dMaxStratRoll     900       /* rolling strategy maximum            */
#define MDB_dMaxRollGeometry  100       /* roll geometry maximum               */
#define MDB_dMaxClass          15       /* max number of material classes      */

                                        /* definitions of string length,       */
                                        /* including '\0'                      */
                                        /* ----------------------------------- */
#define MDB_dSlabNoLen         4        /* slab number                         */
#define MDB_dHeatNoLen         8        /* heat number                         */
#define MDB_dShiftIdLen        9        /* shift identification                */
#define MDB_dGradeLen          6        /* steel grade                         */
#define MDB_dMillOrderNoLen   12        /* mill order number                   */
#define MDB_dCustomerLen      21        /* customer name                       */
#define MDB_dInspCodeLen       5        /* inspection code                     */
#define MDB_dTestCodeLen       5        /* test code                           */
#define MDB_dSpecInstrLen     81        /* special instructions                */
#define MDB_dDispCodeLen       3        /* disposition code                    */
#define MDB_dDefectCodeLen     5        /* defect code                         */
```

```
#define MDB_dRemarksLen      81      /* HM remarks                          */
#define MDB_dIdUserLen        7      /* user                                */
#define MDB_dRollUnitCodeLen  5      /* unit code (rolls)                   */
#define MDB_dMaxRollType      2      /* max no. of roll types               */
#define MDB_dMaxPosType       2      /* max no. of position types           */

                                     /* general definitions                 */
                                     /* ----------------------------------- */
#define OFF                   0      /* value for OFF                       */
#define ON                    1      /* value for ON                        */
#define BLIND_PASS            0      /* value blind pass                    */
#define ACTIVE_PASS           1      /* value active pass                   */

/* ------------------- Definitions for tracking image ---------------------- */
                                     /*                                     */
#define TRA_dMaxTableCover   4       /* max number of table covers          */
#define TRA_dMaxNoSect       5       /* slab sections                       */
#define TRA_dMaxNoSlabsRHF  30       /* max number of slabs in RHF          */
#define TRA_dMaxNoSlabsWEBA  5       /* max number of slabs in WEBA         */
#define TRA_dMaxNoSlabsPool 10       /* max number of slabs in pool         */
                                     /*                                     */
/* ------------------------------------------------------------------------ */
```

2.3 Type Definitions

```
                                    /* definitions for string types        */
                                    /* ---------------------------------- */
typedef  char   MDB_SlabNo          [MDB_dSlabNoLen];
typedef  char   MDB_HeatNo          [MDB_dHeatNoLen];
typedef  char   MDB_ShiftId         [MDB_dShiftIdLen];
typedef  char   MDB_Grade           [MDB_dGradeLen];
typedef  char   MDB_MillOrderNo     [MDB_dMillOrderNoLen];
typedef  char   MDB_Customer        [MDB_dCustomerLen];
typedef  char   MDB_InspCode        [MDB_dInspCodeLen];
typedef  char   MDB_TestCode        [MDB_dTestCodeLen];
typedef  char   MDB_SpecInstr       [MDB_dSpecInstrLen];
typedef  char   MDB_DispCode        [MDB_dDispCodeLen];
typedef  char   MDB_DefectCode      [MDB_dDefectCodeLen];
typedef  char   MDB_Remarks         [MDB_dRemarksLen];
typedef  char   MDB_IdUser          [MDB_dIdUserLen];
typedef  char   MDB_RollUnitCode    [MDB_dRollUnitCodeLen];

                                    /* definitions for numerical types     */
                                    /* ---------------------------------- */
typedef long     MDB_PasNo;         /* RM pass number                      */
typedef long     MDB_SeqNo;         /* sequence number                     */
typedef long     MDB_StandNo;       /* FM stand number                     */
typedef long     MDB_RecipeNo;      /* rolling recipe number               */
typedef long     MDB_ActBlind;      /* active/blind pass indicator         */
typedef long     MDB_StationId;     /* Station Identification              */
typedef float    MDB_Deltim;        /* delta time                          */
typedef TIM_Time MDB_Abstim;        /* absolute time                       */


/*                          +------------------+                           */
/*************************|  STAND NUMBERS   |*****************************/
/*                          +------------------+                           */
typedef enum                        /*                                     */
{                                   /*                                     */
  MDB_eStandPE = -2,                /* Primary Edger                       */
  MDB_eStandRM = -1,                /* Roughing Mill stand                 */
  MDB_eStandF0 =  0,                /* FM stand: F0 (reserved for future)  */
  MDB_eStandF1,                     /*           F1                        */
  MDB_eStandF2,                     /*           F2                        */
  MDB_eStandF3,                     /*           F3                        */
  MDB_eStandF4,                     /*           F4                        */
  MDB_eStandF5,                     /*           F5                        */
  MDB_eStandF6                      /*           F6                        */
                                    /*                                     */
} MDB_StandNo_e;                    /*                                     */
/*****************************************************************************/
```

```
/*                   +--------------------------------+                      */
/*******************|  STAND, ROLL & POSITION TYPES  |***********************/
/*                   +--------------------------------+                      */
typedef enum                          /*                                    */
{                                     /* ---------------------------------- */
  MDB_eStandTypeRM = 0,               /* 0 ... roughing mill                */
  MDB_eStandTypeFM = 1                /* 1 ... finishing mill               */
} MDB_StandType_e;                    /* ---------------------------------- */
                                      /*                                    */
typedef enum                          /* roll type:                         */
{                                     /* ---------------------------------- */
  MDB_eRollTypeWR  = 0,               /* 0 ... Work roll                    */
  MDB_eRollTypeBR  = 1                /* 1 ... Backup roll                  */
} MDB_RollType_e;                     /* ---------------------------------- */
                                      /*                                    */
typedef enum                          /* position type:                     */
{                                     /* ---------------------------------- */
  MDB_ePosTypeBottom  = 0,            /* 0 ... Bottom                       */
  MDB_ePosTypeTop     = 1             /* 1 ... Top                          */
} MDB_PosType_e;                      /* ---------------------------------- */
/*****************************************************************************/


/*                    +-------------------------+                            */
/*********************|  DATABASE ACCESS MODES  |**************************/
/*                    +-------------------------+                            */
typedef enum                          /*                                    */
{                                     /*                                    */
  MDB_eModeRead        = 0,           /*  read access                       */
  MDB_eModeWrite,                     /*  write access (create if not exist) */
  MDB_eModeUpdate,                    /*  write access (don't create if not  */
                                      /*  exist)                            */
  MDB_eModeMarkDelete,                /*  mark data for delete              */
  MDB_eModeDelete,                    /*  delete                            */
  MDB_eModeExcluRead,                 /*  exclusive  read                   */
  MDB_eModeExcluWrite,                /*  exclusive  write                  */
  MDB_eModeDelAccess,                 /*  delete                            */
  MDB_eModeBlockDelete,               /*  block delete                      */
  MDB_eModeTabDelete,                 /*  table delete                      */
  MDB_eModeCheck       = 10,          /* check mode internal used           */
  MDB_eModeNew,                       /*  write access (create in any case) */
  MDB_eModeKeyFill                    /*  fill mdb_key_acc structure */
                                      /*                                    */
} MDB_AccessMode_e;                   /*                                    */
/*****************************************************************************/
```

```
/*                      +-------------------------+                          */
/**********************|  DATABASE RECORD NAMES  |**************************/
/*                      +-------------------------+                          */
typedef enum                          /*                                    */
{                                     /* 0xx  Internal Data:                */
  MDB_eTra              = 001,        /* 001  ... tracking image            */
  MDB_eStationInfo,                   /* 002  ... display access information */
                                      /* ---------------------------------- */
                                      /* 1xx  Primary Data:                 */
  MDB_ePdatSlab         = 100,        /* 100  ... primary data for slabs    */
                                      /* ---------------------------------- */
                                      /* 2xx  Target Data:                  */
  MDB_eTdatRMgeneral    = 230,        /* 230  ... general setup data RM     */
  MDB_eTdatRMpass,                    /* 231  ... pass setup data RM        */
  MDB_eTdatFMgeneral    = 240,        /* 240  ... general setup data FM     */
  MDB_eTdatFMstand,                   /* 241  ... stand spec. setup data FM */
  MDB_eTdatCooling      = 250,        /* 250  ... cooling data              */
                                      /* ---------------------------------- */
                                      /* 3xx  Actual Data:                  */
  MDB_eAdatRF           = 310,        /* 310  ... furnace reheating data    */
                                      /*                                    */
  MDB_eAdatPE           = 320,        /* 320  ... rolling data PE           */
                                      /*                                    */
  MDB_eAdatRMgeneral    = 330,        /* 330  ... general rolling data RM   */
  MDB_eAdatRMpass,                    /* 331  ... rolling pass data RM      */
  MDB_eAdatRMraw,                     /* 332  ... pass raw data RM          */
                                      /*                                    */
  MDB_eAdatFMgeneral    = 340,        /* 340  ... general rolling data FM   */
  MDB_eAdatFMstand,                   /* 341  ... stand spec. rolling data FM*/
  MDB_eAdatFMrawStand,                /* 342  ... stand spec. raw data FM   */
  MDB_eAdatFMrawEntry,                /* 343  ... entry raw data FM         */
  MDB_eAdatFMrawExit,                 /* 344  ... exit raw data FM          */
  MDB_eAdatFMrawFinish,               /* 345  ... finishing raw data FM     */
                                      /* ---------------------------------- */
                                      /* 4xx  Setup Reference Table Data:   */
  MDB_eSdatRMgeneral    = 430,        /* 430  ... general SRT RM            */
  MDB_eSdatRMpass,                    /* 431  ... pass SRT RM               */
  MDB_eSdatFMgeneral    = 440,        /* 440  ... general SRT FM            */
  MDB_eSdatFMstand,                   /* 441  ... stand spec. SRT FM        */
  MDB_eSdatCooling      = 450,        /* 450  ... cooling SRT               */
                                      /* ---------------------------------- */
                                      /* 5xx  Model Data:                   */
  MDB_eMdatGeneral      = 500,        /* 500  ... General model data        */
  MDB_eMdatSteelGrade,                /* 501  ... Steel grade reference table*/
  MDB_eMdatMatLaw,                    /* 502  ... Material law              */
  MDB_eMdatMatProp,                   /* 503  ... Material properties       */
  MDB_eMdatDescale,                   /* 504  ... Descaling                 */
  MDB_eMdatIntCool,                   /* 505  ... Interstand cooling        */
  MDB_eMdatLooperStrat,               /* 506  ... Looper strategy           */
  MDB_eMdatRolStrat,                  /* 507  ... Rolling strategy          */
  MDB_eMdatRollGeometry,              /* 508  ... Roll geometry             */
  MDB_eMdatStretchRM,                 /* 509  ... Stretch curve RM          */
  MDB_eMdatStretchFM,                 /* 510  ... Stretch curve FM          */
  MDB_eMdatAdaptor,                   /* 511  ... Adaptors                  */
                                      /* ---------------------------------- */
                                      /* 7xx  Roll Inventory Data:          */
  MDB_eRollInvR0        = 700,        /* 700  ... record R0: available rolls */
  MDB_eRollInvR1,                     /* 701  ... record R1: roll spec. data */
                                      /* ---------------------------------- */
  MDB_eStandData        = 800,        /* 800  ... stand data                */
  MDB_eGeneralData                    /* 801  ... general data              */
                                      /* ---------------------------------- */
} MDB_RecordName_e;                   /*                                    */
/*****************************************************************************/
```

```
/*                 +---------------------------------------+                */
/*****************|  Value / Min / Max type for FLOAT data  |****************/
/*                 +---------------------------------------+                */
typedef struct                      /*                                      */
{                                   /*                                      */
  float            val;             /* data value                           */
  float            min;             /* min. value                           */
  float            max;             /* max. value                           */
                                    /*                                      */
} MDB_VMMfloat;                     /*                                      */
/*****************************************************************************/


/*                        +----------------------+                           */
/************************|     Station Info     |***************************/
/*                        +----------------------+                           */
typedef enum                        /*                                      */
{                                   /*                                      */
  MDB_eStationAux = 2,              /* not pulptit specific (default to FM)*/
  MDB_eStationRM  = 1,              /* 1 ... roughing mill pulpit           */
  MDB_eStationFM,                   /* 2 ... finishing mill pulpit          */
  MDB_eStationWEBA                  /* 3 ... weighing-banding shanty        */
                                    /*                                      */
} MDB_Station_e;                    /*                                      */
/*****************************************************************************/
typedef enum                        /*                                      */
{                                   /*                                      */
  MDB_eInfoPlan = 0,                /* 0 ... plan data                      */
  MDB_eInfoAct,                     /* 1 ... actual data                    */
  MDB_eInfoAux                      /* 2 ... auxillary data                 */
                                    /*                                      */
} MDB_Info_e;                       /*                                      */
/*****************************************************************************/

/*                        +----------------------+                           */
/************************|  Production States   |***************************/
/*                        +----------------------+                           */
typedef enum                        /*                                      */
{                                   /*                                      */
  MDB_eCharged = 1,                 /* 1 ... charged into furnace           */
  MDB_eDischarged,                  /* 2 ... discharged                     */
  MDB_eStartPE,                     /* 3 ... start in PE                    */
  MDB_eStartRM,                     /* 4 ... start in RM                    */
  MDB_eStartFM,                     /* 5 ... start in FM                    */
  MDB_eStartDC,                     /* 6 ... start in DC                    */
  MDB_eStartWEBA,                   /* 7 ... coil at weighing/banding       */
  MDB_eEndWEBA,                     /* 8 ... actual weight exist, but not   */
                                    /*       yet confirmed by operator      */
  MDB_eFinished                     /* 9 ... production finished            */
                                    /*                                      */
} MDB_ProdState_e;                  /*                                      */
/*****************************************************************************/


/*                        +----------------------+                           */
/************************|  PdatSlab States     |***************************/
/*                        +----------------------+                           */
typedef enum                        /*                                      */
{                                   /*                                      */
  MDB_eRequested = 1,               /*   1 ... data requested               */
  MDB_eRHF,                         /*   2.... data from RHF                */
  MDB_eOper                         /*   3.... data from operator           */
} MDB_PdatState_e;                  /*                                      */
/*****************************************************************************/
```

```
/*                                +-----------+                                 */
/*********************************|  Descale  |*********************************/
/*                                +-----------+                                 */
typedef struct                          /*                                     */
{                                       /* header values:                      */
                                        /*    0 ... OFF                        */
                                        /*    1 ... ON                         */
  long             primary[2];          /* primary header: 0 ... south         */
                                        /*                 1 ... north         */
                                        /*                                     */
  long             RMdescaler[4];       /* RM descaler   : 0 ... entry top     */
                                        /*                 1 ... entry bottom  */
                                        /*                 2 ... delivery top  */
                                        /*                 3 ... deliv. bottom */
} MDB_Descale;                          /*                                     */
/*************************************************************************/
```

2.4 General DB Records

2.4.1 Tracking Image

Max.Number of Records: 1

Record Length: 877 Byte

Unit: single record, permanently loaded

Keys: none

Record Creation Events: none

Record Deletion Events: none

```
/*                    +--------------------------------+                      */
/*********************|  Tracking Image: Furnace Map   |**********************/
/*                    +--------------------------------+                      */
                                    /*                                        */
typedef struct                      /* RHF slab data:                         */
{                                   /* ---------------------------------- */
  SLI_SlabId       slabId;          /* slab ID                                */
  float            actTemp;         /* actual temperature                     */
  float            actTaperTemp;    /* actual taper temperature of slab       */
                                    /*                                        */
} TRA_RHFslabDat;                   /*                                        */
                                    /*                                        */
typedef struct                      /* furnace map:                           */
{                                   /* ---------------------------------- */
  float            disTemp;         /* temp. of actual discharged slab or     */
                                    /* of next slab to discharge              */
                                    /*                                        */
  long             actNoSlabs;      /* actual number of slabs in furnace      */
                                    /*                                        */
  TRA_RHFslabDat   sd[TRA_dMaxNoSlabsRHF]; /* data for all slabs:            */
                                    /* index = 0 ... slab near discharging */
                                    /*             position                   */
                                    /* index > 0 ... slab near charging    */
                                    /*             position                   */
                                    /* so far actTemp and actTaperTemp are */
                                    /* supplied for index 0 only           */
                                    /*                                        */
} TRA_RHFmap;                       /*                                        */
/*****************************************************************************/
```

```
/*              +-----------------------------------------+                 */
/***************|  Tracking Image: Weighing / Banding Map  |*****************/
/*              +-----------------------------------------+                 */
                                    /*                                      */
typedef struct                      /* WEBA slab data:                      */
{                                   /* ------------------------------------ */
  SLI_SlabId       slabId;          /* slab ID                              */
  float            meaWeight;       /* measured weight                      */
                                    /*                                      */
} TRA_WEBAslabDat;                  /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  long             actNoSlabs;      /* actual number of slabs               */
  TRA_WEBAslabDat  sd[TRA_dMaxNoSlabsWEBA]; /* slab data (FIFO)            */
                                    /* index = 0 ... oldest coil            */
                                    /* index > 0 ... newest coil            */
  SLI_SlabId       confSlabId;      /* slab ID to confirm from operator     */
                                    /*                                      */
} TRA_WEBAmap;                      /*                                      */
/*****************************************************************************/
```

```
/*             +-----------------------------------------+                 */
/**************|  Tracking Image:  Mill map FDRT to DCOI  |*****************/
/*             +-----------------------------------------+                 */
                                    /*                                      */
typedef struct                      /* slab / location info:                */
{                                   /* ------------------------------------ */
  SLI_SlabId       slabId;          /* slab ID                              */
  long             firstLocation;   /* first location of slab               */
  long             noLocation;      /* number of locations, occupied by     */
                                    /* this slab:                           */
                                    /*   0 = no slab present; in this case  */
                                    /*       firstLocation irrelevant       */
} TRA_SlabInfo;                     /*                                      */
                                    /*                                      */
typedef enum                        /* Slab sections:                       */
{                                   /*                                      */
                                    /*  location |location|                 */
                                    /*   number  |  name  |  event/bit       */
/* ------------------------------------------------+--------+-------------- */
  TRA_eSectDT = 0,                  /*      0     |  FDRT  |  discharging     */
/* ------------------------------------------------+--------+-------------- */
                                    /*      1     |  PEET  |  HMD 1           */
                                    /*      2     |  PEET  |  HMD 2           */
                                    /*      3     |  PEET  |  HMD 3           */
  TRA_eSectPE,                      /*      4     |  PEET  |  HMD 4           */
                                    /*      5     |  PEET  |  HMD 5           */
                                    /*      6     |  PE    |  event code      */
                                    /*      7     |  RMET  |  HMD 6           */
                                    /*      8     |  RMET  |  HMD 7           */
/* ------------------------------------------------+--------+-------------- */
                                    /*      9     |  RMET  |  HMD 8           */
                                    /*     10     |  RMET  |  HMD 9           */
                                    /*     11     |  RMET  |  HMD 10          */
                                    /*     12     |  RMET  |  HMD 12          */
  TRA_eSectRM,                      /*     13     |  RM    |  event code      */
                                    /*     14     |  RMDT  |  HMD 13          */
                                    /*     15     |  RMDT  |  HMD 15          */
                                    /*     16     |  RMDT  |  HMD 16          */
                                    /*     17     |  PR    |  HMD 17          */
/* ------------------------------------------------+--------+-------------- */
                                    /*     18     |  F1    |  bit 18          */
                                    /*     19     |  F2    |  bit 19          */
                                    /*     20     |  F3    |  bit 20          */
  TRA_eSectFM,                      /*     21     |  F4    |  bit 21          */
                                    /*     22     |  F5    |  bit 22          */
                                    /*     23     |  F6    |  bit 23          */
                                    /*     24     |  FMRO  |  bit 24 (pyrF6)  */
                                    /*     25     |  FMRO  |  bit 25 (pyrDC)  */
/* ------------------------------------------------+--------+-------------- */
  TRA_eSectDC,                      /*     26     |  DCOI  |  bit 25          */
/* ------------------------------------------------+--------+-------------- */
/*                                                                          */
/****************************************************************************/
/****************************************************************************/
/***** Following two section names are defined for completeness only ! ******/
/***** These names only can be used for passing information to certain ******/
/***** modules, but not as index to SECT[].                           ******/
/*****                                                                ******/
  TRA_eSectRHF  = 100,              /* name for Reheat Furnace          ******/
  TRA_eSectWEBA = 101               /* name for Weighing/Banding        ******/
/****************************************************************************/
/****************************************************************************/
/*                                                                          */
} TRA_Section_e;                    /*                                      */
```

```
typedef enum                          /* Table Cover positions:              */
{                                     /* ---------------------------------- */
  TRA_eTableCoverClosed = 0,          /* Closed                             */
  TRA_eTableCoverInterm,              /* Intermediate Position              */
  TRA_eTableCoverOpen                 /* Open                               */
} TRA_TableCoverPos_e;                /* ---------------------------------- */

typedef enum                          /* Roll cooling states:                */
{                                     /* ---------------------------------- */
  TRA_eRollCoolingOFF   = 0,          /* OFF   ... no water                 */
  TRA_eRollCoolingBASIC,              /* BASIC ... basic water flow         */
  TRA_eRollCoolingON                  /* ON    ... full water flow          */
} TRA_RollCoolingState_e;             /* ---------------------------------- */

typedef struct                        /* mill map:                           */
{                                     /* ---------------------------------- */
  TRA_SlabInfo     sect[TRA_dMaxNoSect];/* sections in relation to slabs    */
                                      /*                                    */
                                      /*                                    */
} TRA_MILLmap;                        /*                                    */
/*************************************************************************/
```

```
/*                    +--------------------------------+                    */
/*********************|  Tracking Image: General data  |********************/
/*                    +--------------------------------+                    */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  long             dischFlag;       /* discharging flag: (for display only)*/
                                    /*  set TRUE from discharging to slab   */
                                    /*  moves away from FDRT                */
} TRA_genRHFdata;                   /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  SLI_SlabId       slabId;          /* ID of actual / last slab             */
  long             active;          /* active/inactive (1/0)                */
} TRA_genPEdata;                    /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  SLI_SlabId       slabId;          /* ID of actual / last slab             */
  long             pasNo;           /* actual/last pass number              */
  long             active;          /* active/inactive (1/0)                */
} TRA_genRMdata;                    /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  SLI_SlabId       slabId;          /* ID of actual / last slab             */
  long             active;          /* active/inactive (1/0)                */
} TRA_genFMdata;                    /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  SLI_SlabId       slabId;          /* ID of actual / last slab             */
  long             active;          /* active/inactive (1/0)                */
} TRA_genDCdata;                    /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  long             noSlabs;         /* number of slabs                      */
  SLI_SlabId       slabId[TRA_dMaxNoSlabsPool];
} TRA_slabPool;                     /*                                      */
                                    /*                                      */
typedef struct                      /*                                      */
{                                   /*                                      */
  long             prvBitmap;       /* previous received tracking bitmap    */
  long             actBitmap;       /* actual received tracking bitmap      */

  long             posTableCover    /* positions for table covers 1 - 4     */
                 [TRA_dMaxTableCover];/* (south to north)                    */
                                    /* i.e. index 0 = cover, nearest to RM  */
                                    /* positions in TRA_TableCoverPos_e     */

  long             rollCooling      /* roll cooling stand 1 - 6:            */
                 [MDB_dNoStand];    /* states in TRA_RollCoolingState_e     */

  MDB_Descale      descale;         /* actual descaling                     */

  TRA_genRHFdata   RHF;             /* general data RHF                     */
  TRA_genPEdata    PE;              /* general data PE                      */
  TRA_genRMdata    RM;              /* general data RM                      */
  TRA_genFMdata    FM;              /* general data FM                      */
  TRA_genDCdata    DC;              /* general data DC                      */
                                    /*                                      */
} TRA_generalData;                  /*                                      */
/*************************************************************************/
```

```
/*                          +------------------+                              */
/**************************|  Tracking Image  |******************************/
/*                          +------------------+                              */
/*                                                                            */
/* DB access key:  none                                                       */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /*                                    */
  TRA_generalData  general;             /* general data                       */
  TRA_RHFmap       RHFmap;              /* reheat furnace map                 */
  TRA_MILLmap      MILLmap;             /* mill map                           */
  TRA_WEBAmap      WEBAmap;             /* weighing/banding map               */
  TRA_slabPool     slabPool;            /* slab pool                          */
  long             lReserved[10];       /* spare                              */
  float            fReserved[10];       /* spare                              */
                                        /*                                    */
} MDB_Tra;                              /*                                    */
/****************************************************************************/
```

2.4.2 Station Info

Max.Number of Records: 5

Record Length: 33 Byte

Unit: 1 record for RM
1 record for FM
1 record for DC/WEBA
1 record station independent
1 spare

Keys: - Station Identification

Record Creation Events: - Slab Id related event

Record Deletion Events: - none

```
/*                  +-----------------------------------+                     */
/******************|  DB ROW: DISPLAY DEFAULT TABLE    |*********************/
/*                  +-----------------------------------+                     */
/*                                                                            */
/* DB access key:  MDB_StationId                                              */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                        /*                                      */
{                                     /*                                      */
  SLI_SlabId   slabId;                /* slab id                              */
  MDB_PasNo    pasNo;                 /* pass number                          */
                                      /*                                      */
} MDB_DefInfo;                        /*                                      */
                                      /*                                      */
typedef struct                        /*                                      */
{                                     /*                                      */
  MDB_DefInfo  info[3];               /* index: MDB_eInfoPlan                 */
                                      /*        MDB_eInfoAct                  */
                                      /*        MDB_eInfoAux                  */
} MDB_StationInfo;                    /*                                      */
/*                                                                            */
/******************************************************************************/
```

2.4.3 General Data Record

Max.Number of Records: 1

Record Length: 33 Byte

Unit: 1 record

Keys: - none

Record Creation Events: - none

Record Deletion Events: - none

```
/*                          +----------------------+                          */
/***************************| DB ROW: GENERAL DATA |**************************/
/*                          +----------------------+                          */
/*                                                                            */
/* DB access key:  none                                                       */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /* plant data:                        */
                                        /* -----------                        */
  float            diameterPE;          /* PE roll diameter                   */
  float            diameterRMedger;     /* RM edger roll diameter             */
                                        /*                                    */
  MDB_IdUser       idRollerRM;          /* roller RM                          */
  MDB_IdUser       idRollerFM;          /* roller FM                          */
  MDB_IdUser       idWeiBan;            /* weigher / bander                   */
                                        /*                                    */
                                        /* MMI reserved data:                 */
  long             matLawCode;          /* work space for MMI for matLaw index */
                                        /*                                    */
} MDB_GeneralData;                      /*                                    */
/******************************************************************************/
```

2.5 Primary Data

Max.Number of Records: 40

Record Length: 669 Byte

Unit: 1 record per material

Keys: - Slab Identification

Record Creation Events: - primary data transmission

Record Deletion Events:
- coil confirmed by weigher/bander
- slab deleted by operator (e.g. cobble)
- automatic delete on weigher/bander queue overflow
- automatic cobble detection (if not previously deleted by operator)

```
/*                  +-----------------------------------+                    */
/******************|        Information Record         |********************/
/*                  +-----------------------------------+                    */
typedef struct                      /*                                       */
{                                   /*                                       */
  MDB_PdatState_e  state;           /* state of data content                 */
  MDB_Abstim       crtTime;         /* creation time                         */
  long             modId;           /* modifier ID: 1 - operator on HSM      */
                                    /*              2 - external computer    */
  MDB_Abstim       modTime;         /* modification time                     */
  MDB_ProdState_e  prodState;       /* actual production state               */
  MDB_Abstim       finTime;         /* finishing time                        */
  long             valid;           /* data validity flag:                   */
                                    /*   -2 ... major data error (no SRT     */
                                    /*          and no FM Model will run)    */
                                    /*   -1 ... major data error (FM Model   */
                                    /*          will not run)                */
                                    /*    0 ... minor data error (SRT and    */
                                    /*          FM Model will run)           */
                                    /*    1 ... data are OK                  */
                                    /*                                       */
  long             deleteCode;      /* used, when slab data deleted         */
                                    /* manually                              */
  long             pfaffyLikesThisOne;/* dont delete this one (Martina      */
                                    /*  wants to keep it): TRUE/FALSE 1/0    */
                                    /*                                       */
  MDB_IdUser       idRollerRM;      /* roller RM                             */
  MDB_IdUser       idRollerFM;      /* roller FM                             */
  MDB_IdUser       idWeiBan;        /* weigher / bander                      */
  MDB_DispCode     dispCode;        /* disposition code (from operator)      */
  MDB_DefectCode   defectCode;      /* defect code (from operator)           */
  MDB_Remarks      remarks;         /* HM remarks (from operator)            */
                                    /*                                       */
} MDB_PdatSlabInfo;                 /*                                       */
/*************************************************************************/
```

```
/*                          +-----------------+                               */
/***************************|  General Data   |*******************************/
/*                          +-----------------+                               */
typedef struct                          /*                                   */
{                                       /*                                   */
  MDB_SlabNo       slabNo;            /* slab number                        */
  MDB_HeatNo       heatNo;            /* heat number                        */
  float            len;               /* slab length                        */
  float            widthHead;         /* slab width at head                 */
  float            widthTail;         /* slab width at tail                 */
  float            thick;             /* slab thickness                     */
  float            lenCold;           /* slab length (cold)                 */
  float            widthHeadCold;     /* slab width at head (cold)          */
  float            widthTailCold;     /* slab width at tail (cold)          */
  float            thickCold;         /* slab thickness (cold)              */
  float            weight;            /* slab weight                        */
  float            weightCrop;        /* crop weight                        */
  float            weightSS;          /* scrap and sample weight            */
  float            aveSpeedMold;      /* average speed at mold              */
  MDB_Grade        steelGrade;        /* final steel grade                  */
  long             numSteelGrade;     /* numeric steel grade                */
  char             alloyNumber[5];    /* alloy number (correction factor)   */
  MDB_MillOrderNo  millOrderNo;       /* mill order number                  */
  MDB_Customer     customer;          /* customer name                      */
  MDB_InspCode     inspCode;          /* inspection code                    */
  MDB_TestCode     testCode;          /* test code                          */
  MDB_SpecInstr    specInstr;         /* special instructions               */
  MDB_DispCode     dispCode;          /* disposition code for slab (from CC) */
  MDB_DefectCode   defectCode;        /* defect code for slab (from CC)     */
  MDB_DefectCode   defectCode2;       /* defect code for slab (from CC)     */
  MDB_DefectCode   defectCode3;       /* defect code for slab (from CC)     */
                                      /*                                    */
} MDB_PdatSlabGn;                     /*                                    */
/*****************************************************************************/
```

```
/*                            +-----------------+                             */
/*****************************|  Analysis Data  |*****************************/
/*                            +-----------------+                             */
typedef enum                              /* pointer to analysis element array   */
{                                         /* ----------------------------------- */
  MDB_eAnaSum = 0,                        /* sum of all elements                 */
  MDB_eAnaFe,                             /* Fe                                  */
  MDB_eAnaC,                              /* C                                   */
  MDB_eAnaMn,                             /* Mn                                  */
  MDB_eAnaP,                              /* P                                   */
  MDB_eAnaS,                              /* S                                   */
  MDB_eAnaSi,                             /* Si                                  */
  MDB_eAnaCu,                             /* Cu                                  */
  MDB_eAnaNi,                             /* Ni                                  */
  MDB_eAnaCr,                             /* Cr                                  */
  MDB_eAnaMo,                             /* Mo                                  */
  MDB_eAnaSn,                             /* Sn                                  */
  MDB_eAnaV,                              /* V                                   */
  MDB_eAnaAl,                             /* Al                                  */
  MDB_eAnaPb,                             /* Pb                                  */
  MDB_eAnaCo,                             /* Co                                  */
  MDB_eAnaZr,                             /* Zr                                  */
  MDB_eAnaNb,                             /* Nb                                  */
  MDB_eAnaCe,                             /* Ce                                  */
  MDB_eAnaW,                              /* W                                   */
  MDB_eAnaTi,                             /* Ti                                  */
  MDB_eAnaN2                              /* N2                                  */
} MDB_AnaElement_e;                       /* ----------------------------------- */
                                          /*                                     */
typedef struct                            /*                                     */
{                                         /*                                     */
  float      ele[MDB_dNoAnaElements];     /* chemistry element                   */
                                          /*                                     */
} MDB_PdatSlabAna;                        /*                                     */
/*************************************************************************/


/*                            +-----------------+                             */
/*****************************|  Furnace Data   |*****************************/
/*                            +-----------------+                             */
typedef struct                            /*                                     */
{                                         /*                                     */
  float            tgtDischTemp;        /* target discharging temperature      */
                                          /*                                     */
} MDB_PdatSlabRHF;                        /*                                     */
/*************************************************************************/


/*                               +------------+                               */
/*******************************|  RM Data   |*******************************/
/*                               +------------+                               */
typedef struct                            /*                                     */
{                                         /*                                     */
  MDB_RecipeNo     planRecipeNo;        /* planned RM recipe number            */
  float            tgtExitTemp;         /* target RM exit temperature          */
  float            tgtTBthick;          /* target transfer bar thickness       */
                                          /*                                     */
} MDB_PdatSlabRM;                         /*                                     */
/*************************************************************************/
```

```
/*                                +-----------+                                 */
/*********************************|  FM Data  |*********************************/
/*                                +-----------+                                 */
typedef struct                          /*                                     */
{                                       /*                                     */
  MDB_RecipeNo     planRecipeNo;      /* planned FM recipe number             */
  MDB_VMMfloat     tgtStripThick;     /* target strip thickness               */
  MDB_VMMfloat     tgtStripWidth;     /* target strip width                   */
  MDB_VMMfloat     tgtTempF6;         /* target temperature after F6          */
  float            altStripThick;     /* alternate strip thickness if         */
                                      /* target strip thickness not reached   */
                                      /*                                      */
} MDB_PdatSlabFM;                     /*                                      */
/*****************************************************************************/


/*                               +-----------------+                           */
/*****************************|  Cooling Data  |******************************/
/*                               +-----------------+                           */
typedef struct                          /*                                     */
{                                       /*                                     */
  MDB_RecipeNo     planRecipeNo;      /* planned cooling recipe number        */
                                      /*                                      */
} MDB_PdatSlabCooling;                /*                                      */
/*****************************************************************************/


/*                                +-----------+                                 */
/*********************************|  DC Data  |*********************************/
/*                                +-----------+                                 */
typedef struct                          /*                                     */
{                                       /*                                     */
  MDB_VMMfloat     tgtCoilTemp;       /* target coiling temperature           */
                                      /*                                      */
} MDB_PdatSlabDC;                     /*                                      */
/*****************************************************************************/


/*                         +-------------------------+                         */
/***************************|  DB ROW: PRIMARY DATA  |************************/
/*                         +-------------------------+                         */
/*                                                                             */
/* DB access key:  SLI_SlabId                                                  */
/*                                                                             */
/* --------------------------------------------------------------------------- */
typedef struct                          /*                                     */
{                                                                              */
  MDB_PdatSlabInfo       info;        /* info record                          */
  MDB_PdatSlabGn         gn;          /* general data                         */
  MDB_PdatSlabAna        analysis;    /* analysis data                        */
  MDB_PdatSlabRHF        rhf;         /* furnace data                         */
  MDB_PdatSlabRM         rm;          /* RM data                              */
  MDB_PdatSlabFM         fm;          /* FM data                              */
  MDB_PdatSlabCooling    cooling;     /* Cooling data                         */
  MDB_PdatSlabDC         dc;          /* DC data                              */
                                      /*                                      */
} MDB_PdatSlab;                       /*                                      */
/*****************************************************************************/
```

2.6 Setup Data

2.6.1 General Setup Data RM

Max.Number of Records: 40

Record Length: 16 Byte

Unit: 1 record per material

Keys: - Slab Identification

Record Creation Events: - charging of furnace

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                    +---------------------------------+                    */
/*********************|  DB ROW: GENERAL SETUP DATA RM  |*********************/
/*                    +---------------------------------+                    */
/*                                                                           */
/* DB access key:  SLI_SlabId                                                */
/*                                                                           */
/* ------------------------------------------------------------------------- */
typedef struct                        /*                                     */
{                                     /*                                     */
  MDB_RecipeNo     adjRecipeNo;       /* adjusted rolling recipe number      */
  long             nPas;              /* number of passes                    */
  float            edgAdjustPE;       /* edger adjust PE                     */
  float            descSpeed;         /* descaling speed [fpm]               */
                                      /*                                     */
} MDB_TdatRMgeneral;                  /*                                     */
/*****************************************************************************/
```

2.6.2 Pass Setup Data RM

Max.Number of Records: 360

Record Length: 68 Byte

Unit: 1 record per material and pass in the roughing mill

Keys: - Slab Identification
- Pass Number

Record Creation Events: - creation of *General Setup Data RM*

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                      +------------------------------+                      */
/**********************|  DB ROW: PASS SETUP DATA RM  |**********************/
/*                      +------------------------------+                      */
/*                                                                            */
/* DB access key:  SLI_SlabId                                                 */
/*                 MDB_PasNo                                                  */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /*                                    */
  MDB_ActBlind     activeBlind;         /* active / blind pass indicator      */
  float            posSGRMET;           /* position side guide RM entry table */
  float            posSGRMDT;           /* position side guide RM deliv.table */
  float            millEntrySpeed;      /* mill entry speed                   */
  float            millRunSpeed;        /* mill run speed                     */
  float            edgEntrySpeed;       /* edger entry speed                  */
  float            edgRunSpeed;         /* edger run speed                    */
  float            screwDown;           /* rougher screw down (noload gap)    */
  float            edgAdjust;           /* edger adjust                       */
                                        /*     -1 = not used (even pass)      */
  MDB_Descale      descale;             /* descale settings                   */
                                        /*                                    */
  float            loadGap;             /* load gap                           */
  float            force;               /* roll force                         */
                                        /*                                    */
} MDB_TdatRMpass;                       /*                                    */
/******************************************************************************/
```

2.6.3 General Setup Data FM

Max.Number of Records: 40

Record Length: 152 Byte

Unit: 1 record per material

Keys: - Slab Identification

Record Creation Events: - charging of furnace

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                      +-----------------------------+                       */
/***********************|  Descale PR scale breaker   |***********************/
/*                      +-----------------------------+                       */
typedef struct                        /*                                      */
{                                     /*                                      */
  long             code;              /* code value:                          */
                                      /*    0 ... OFF                         */
                                      /*    1 ... ON                          */
                                      /*                                      */
  MDB_Deltim       timeON;            /* time to be on (sec)                  */
                                      /*                                      */
} MDB_PRdescale;                      /*                                      */
/*****************************************************************************/


/*                     +---------------------------------+                   */
/********************|  DB ROW: GENERAL SETUP DATA FM  |*********************/
/*                     +---------------------------------+                   */
/*                                                                           */
/* DB access key:  SLI_SlabId                                                */
/*                                                                           */
/* ------------------------------------------------------------------------- */
typedef struct                        /*                                      */
{                                     /*                                      */
  MDB_RecipeNo     adjRecipeNo;       /* adjusted rolling recipe number:      */
                                      /*   0 = data from process model        */
                                      /*  >0 = data from table                */
  float            widthTB;           /* transfer bar width                   */
  float            thickTB;           /* transfer bar thickness               */
  float            finalWidth;        /* final strip width                    */
  float            tgtTempF6;         /* target temperature after F6          */
  float            posSGPR;           /* position PR scale breaker side guide*/
  float            speedPR;           /* speed PR scale breaker               */
  MDB_PRdescale    PRdescale[2];      /* PR scale breaker descaling:          */
                                      /*         0 ... south                  */
                                      /*         1 ... north                  */
  float            tempDev;           /* temperature deviation                */
  float            thickDev;          /* thickness deviation                  */
  float            specSlope;         /* specific slope shape control         */
  float            specForce;         /* spec. target roll force stand F6     */
  float            specSlopeOrig;     /* original spec. slope shape control   */
  float            specForceOrig;     /* original spec. target roll force F6 */
```

```
  long            stateFMcalc;      /* state FM calculation                */
  long            stateAdaThick;    /* thick. adaptor was used (0/1 NO/YES)*/
  long            stateAdaSpeed;    /* speed adaptor was used (0/1 NO/YES) */
  long            gapCorrOn;        /* gap correction was ON/OFF           */
  long            flagThickness;    /* 1 ... scheduled thickness reached   */
  long            flagCalc;         /*  0 ... no calculation               */
                                    /*  1 ... Precalculation               */
                                    /*  2 ... Calculation                  */
                                    /*  4 ... Recalculation                */
                                    /*  8 ... Adaption                     */
                                    /* 16 ... Limit checks ON              */
                                    /*                                     */
  long            flagValid;        /* 0 ... no valid pass schedule        */
                                    /* 1 ... valid pass schedule Precalc.  */
                                    /* 2 ... valid pass schedule Calc.     */
                                    /* 4 ... valid pass schedule Recalc.   */
                                    /*                                     */
  float           tgtStripThickHot; /* target strip thickness hot          */
  float           tgtStripThickCold;/* target strip thickness cold         */

  float           fReserved[6];     /* 0 ... final target thickness        */
                                    /* 1 - 5 spare                         */
                                    /*                                     */

  long            lReserved[6];     /* 0 ... draft change allowed (0/1)    */
                                    /* 1 ... force gradient ON/OFF         */
                                    /* 2 ... long term ada used YES/NO     */
                                    /* 3 - 5 spare                         */
                                    /*                                     */
} MDB_TdatFMgeneral;                /*                                     */
/*************************************************************************/
```

2.6.4 Stand Specific Setup Data FM

Max.Number of Records: 240

Record Length: 192 Byte

Unit: 1 record per material and stand

Keys: - Slab Identification
- Stand number

Record Creation Events: - charging of furnace

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                 +---------------------------------------+                */
/*****************|  DB ROW: STAND SPECIFIC SETUP DATA FM  |*****************/
/*                 +---------------------------------------+                */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                 MDB_StandNo                                              */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                          /*                                  */
{                                       /*                                  */
  float            posEntrySG;          /* position stand entry side guide  */
  float            speed;               /* speed main drive (roll circumferen.)*/
  float            force;               /* roll force                       */
  float            exitThick;           /* stand exit thickness             */
  float            fwSlip;              /* forward slip                     */
  float            bwSlip;              /* backward slip                    */
  float            stretch;             /* stretch                          */
  float            rollWear;            /* roll wear                        */
  float            thermCrown;          /* thermal crown                    */
  float            asymFinValue;        /* asymptotic final value           */
  float            timeConstCrown;      /* time constant thermal crown      */
  float            looperAngle;         /* looper angle ( for F6 empty )    */
  float            specTension;         /* specific tension ( F6 empty )    */
  float            entryThick;          /* entry thickness                  */
  float            entryThickCold;      /* cold entry thickness             */
  float            exitThickCold;       /* cold exit thickness              */
  float            epsPerc;             /* percentage reduction             */
  float            entryTemp;           /* entry temperature                */
  float            exitTemp;            /* exit temperature                 */
  float            torque;              /* roll torque                      */
  float            entrySpeed;          /* entry strip speed                */
  float            exitSpeed;           /* exit strip speed                 */
  float            exitWidth;           /* exit width                       */
  float            exitWidthCold;       /* cold exit width                  */
  float            dur;                 /* duration strip in stand          */
  float            utility;             /* motor utility                    */
  float            biteAngle;           /* bite angle                       */
  float            heatTrans;           /* heat transition strip <-> roll   */
  float            length;              /* rolled strip length              */
  float            startTemp;           /* mean roll temp. at start of pass */
```

```
  float            endTemp;          /* mean roll temp. at end of pass      */
  float            totStretch;       /* total stretch                       */
  float            calibStretch;     /* stretch from calibration            */
  float            profile;          /* strip profile                       */
  float            power;            /* motor power                         */
  float            neutralThick;     /* neutral thickness                   */
  float            thickSetpoint;    /* setpoint thickness                  */
  float            speedSetpoint;    /* setpoint speed                      */
                                     /*                                     */
  long             limSpeed;         /* Flag: speed limited by mill restr.  */
                                     /*                                     */
                                     /* Flag: thickness red. limited by:    */
                                     /* --------------------------------    */
  long             limSpecForce;     /* spec. roll force                    */
  long             limSpecForceF6;   /* spec. roll force F6                 */
  long             limForce;         /* roll force                          */
  long             limTorque;        /* roll torque                         */
                                     /*                                     */
  float            fReserved[5];     /* 0 ... force gradient                */
                                     /* 1 ... calculated yield stress [psi] */
                                     /* 2 - 4 spare                         */
                                     /*                                     */
} MDB_TdatFMstand;                   /*                                     */
/*************************************************************************/
```

2.6.5 Target Strip Cooling Data

Max.Number of Records: 40

Record Length: 68 Byte

Unit: 1 record per material

Keys: - Slab Identification

Record Creation Events: - charging of furnace

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                          +--------------------+                          */
/***************************|  Cooling Pattern   |***************************/
/*                          +--------------------+                          */
                                    /* values for all sections are:        */
                                    /*    0 ... OFF                        */
                                    /*    1 ... ON                         */
                                    /*                                     */
typedef struct                      /* top cooling section:                */
{                                   /* --------------------                */
  long             section[10];     /* 1 -  6: Main cooling section        */
                                    /* 7 - 10: Trim cooling section        */
} MDB_CPtop;                        /*                                     */
                                    /*                                     */
typedef struct                      /* bottom cooling section:             */
{                                   /* -----------------------             */
  long             section[4];      /* Sections 1 - 4                      */
                                    /*                                     */
} MDB_CPbot;                        /*                                     */
                                    /*                                     */
typedef struct                      /* cooling pattern:                    */
{                                   /* ----------------                    */
  MDB_CPtop        top;             /* top cooling section                 */
  MDB_CPbot        bot;             /* bottom cooling section              */
                                    /*                                     */
} MDB_CoolPattern;                  /*                                     */
/*****************************************************************************/

/*                      +--------------------------------+                  */
/***********************|  DB ROW: TARGET COOLING DATA   |*********************/
/*                      +--------------------------------+                  */
/*                                                                           */
/* DB access key:  SLI_SlabId                                                */
/*                                                                           */
/* ------------------------------------------------------------------------- */
typedef struct                      /*                                     */
{                                   /*                                     */
  MDB_RecipeNo     adjRecipeNo;     /* adjusted cooling recipe number      */
  long             durF2toStart;    /* duration from F2 to start of cooling*/
  long             durF2toEnd;      /* duration from F2 to end of cooling  */
  MDB_CoolPattern  coolPattern;     /* cooling pattern                     */
                                    /*                                     */
} MDB_TdatCooling;                  /*                                     */
```

/***/

2.7 Reference Table Data

2.7.1 General Setup Reference Table RM

Max.Number of Records: 30

Record Length: 30 Byte

Unit: 1 record per rolling recipe for RM

Keys: - RM recipe number

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*              +-------------------------------------------+              */
/***************|  DB ROW: GENERAL SETUP REFERENCE TABLE RM  |***************/
/*              +-------------------------------------------+              */
/*                                                                         */
/* DB access key:  MDB_RecipeNo                                           */
/*                                                                         */
/* ----------------------------------------------------------------------- */
typedef struct                      /*                                     */
{                                   /* data values:                        */
                                    /* ------------                        */
  float           refSlabWidthCold; /* reference slab width (cold)         */

  MDB_PasNo       nPas;             /* number of passes                    */
  MDB_Abstim      modTime;          /* date and time of last modification  */
  float           offsetPE;         /* PE offset                           */
  float           descSpeed;        /* descaling speed [fpm]               */
                                    /*                                     */
} MDB_SdatRMgeneral;                /*                                     */
/*************************************************************************/
```

2.7.2 Pass Setup Reference Table RM

Max.Number of Records: 270

Record Length: 68 Byte

Unit: 1 record per RM recipe and pass in the roughing mill

Keys: - RM recipe number
- Pass Number

Record Creation Events: - creation of *General Setup Reference Table RM*

Record Deletion Events: - deletion of *General Setup Reference Table RM*

```
/*                 +----------------------------------------+               */
/*****************|  DB ROW: PASS SETUP REFERENCE TABLE RM  |***************/
/*                 +----------------------------------------+               */
/*                                                                          */
/* DB access key:  MDB_RecipeNo                                             */
/*                 MDB_PasNo                                                */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                      /*                                      */
{                                   /*                                      */
  MDB_ActBlind     activeBlind;     /* active / blind pass indicator        */
  float            offsetSGRMET;    /* offset side guide RM entry table     */
  float            offsetSGRMDT;    /* offset side guide RM deliv.table     */
  float            millEntrySpeed;  /* mill entry speed                     */
  float            millRunSpeed;    /* mill run speed                       */
  float            edgEntrySpeed;   /* edger entry speed                    */
  float            edgRunSpeed;     /* edger run speed                      */
  float            screwDown;       /* rougher screw down (noload gap)      */
  float            offsetRMedger;   /* offset RMedger                       */
  MDB_Descale      descale;         /* descale settings                     */
  float            refLoadGap;      /* reference load gap                   */
  float            refForce;        /* reference force                      */
} MDB_SdatRMpass;                   /*                                      */
/*************************************************************************/
```

2.7.3 General Setup Reference Table FM

Max.Number of Records: 5

Record Length: 42 Byte

Keys: - FM recipe number

Remark: not used (FM model only)

2.7.4 Stand Specific Setup Reference Table FM

Max.Number of Records: 30

Record Length: 24 Byte

Keys: - FM recipe number
- Stand Number

Remark: not used (FM model only)

2.7.5 Strip Cooling Reference Table

Max.Number of Records: 200

Record Length: 78 Byte

Unit: 1 record per cooling recipe

Keys: - Cooling recipe number

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                +-----------------------------------------+               */
/*****************|  DB ROW: STRIP COOLING REFERENCE TABLE  |***************/
/*                +-----------------------------------------+               */
/*                                                                          */
/* DB access key:  MDB_RecipeNo                                            */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                      /*                                      */
{                                   /* values:                              */
                                    /* -------                              */
  MDB_Abstim       modTime;         /* date and time of last modification   */
  long             durF2toStart;    /* duration from F2 to start of cooling*/
  long             durF2toEnd;      /* duration from F2 to end of cooling   */
  MDB_CoolPattern  coolPattern;     /* cooling pattern                      */
                                    /*                                      */
} MDB_SdatCooling;                  /*                                      */
/**************************************************************************/
```

2.8 Actual Data

2.8.1 Actual Furnace Reheating Data

Max.Number of Records: 40

Record Length: 80 Byte

Unit: 1 record per material

Keys: - Slab Identification

Record Creation Events: - furnace charging

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                +-----------------------------------------+               */
/*****************|  DB ROW: ACTUAL FURNACE REHEATING DATA  |***************/
/*                +-----------------------------------------+               */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                      /*                                      */
{                                   /* charging values:                     */
                                    /* ----------------                     */
  MDB_Abstim       chaTime;         /* charging date and time               */
                                    /*                                      */
                                    /* discharging values:                  */
                                    /* -------------------                  */
  MDB_Abstim       disTime;         /* discharging date and time            */
  float            cDisTempSurTop;  /* calc. disch. temp. surface / top     */
  float            cDisTempSurBot;  /* calc. disch. temp. surface / bottom  */
  float            cDisTempSurCen;  /* calc. disch. temp. center            */
  float            cDisTempSurAve;  /* calc. disch. temp. average           */
  float            cTaperTempAve;   /* calc. taper temp. average            */
  MDB_Deltim       rehTime;         /* actual reheating time                */
                                    /*                                      */
                                    /* recharging values:                   */
                                    /* ------------------                   */
  MDB_Abstim       prevDisTime;     /* previous discharging date and time   */
  MDB_Abstim       rechTime;        /* recharging date and time             */
                                    /*                                      */
} MDB_AdatRF;                       /*                                      */
/**************************************************************************/
```

2.8.2 Actual Rolling Data Primary Edger

Max.Number of Records: 10

Record Length: 40 Byte

Unit: 1 record per material rolled in primary edger

Keys: - Slab Identification

Record Creation Events: - start of rolling in primary edger

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                    +-----------------------------------+                 */
/*********************|  DB ROW: ACTUAL ROLLING DATA PE   |*******************/
/*                    +-----------------------------------+                 */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                          /*                                  */
{                                       /* time schedule:                   */
                                        /* --------------                   */
  MDB_Abstim       timeStartRol;        /* date and time start of rolling   */
  MDB_Abstim       timeEndRol;          /* date and time end of rolling     */
  MDB_Deltim       rolTime;             /* rolling time                     */
                                        /*                                  */
                                        /* rolling data:                    */
                                        /* -------------                    */
  float            edgAdjust;           /* edger adjust                     */
  float            speed;               /* edger speed                      */
                                        /*                                  */
} MDB_AdatPE;                           /*                                  */
/****************************************************************************/
```

2.8.3 Actual General Rolling Data Roughing Mill

Max.Number of Records: 10

Record Length: 40 Byte

Unit: 1 record per material rolled in the roughing mill

Keys: - Slab Identification

Record Creation Events: - start of first pass in roughing mill

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                +-----------------------------------------+              */
/*****************|  DB ROW: ACTUAL GENERAL ROLLING DATA RM  |***************/
/*                +-----------------------------------------+              */
/*                                                                         */
/* DB access key:  SLI_SlabId                                              */
/*                                                                         */
/* ----------------------------------------------------------------------- */
typedef struct                      /*                                     */
{                                   /* time schedule:                      */
                                    /* --------------                      */
  MDB_Abstim       timeStartRol;    /* date and time start of 1. pass      */
  MDB_Abstim       timeEndRol;      /* date and time end of last pass      */
  MDB_Deltim       rolTime;         /* rolling time                        */
                                    /*                                     */
                                    /* rolling data:                       */
                                    /* -------------                       */
  MDB_PasNo        nPas;            /* total number of passes              */
  MDB_RecipeNo     actRecipeNo;     /* actual recipe number                */
                                    /*                                     */
} MDB_AdatRMgeneral;                /*                                     */
/*************************************************************************/
```

2.8.4 Actual Rolling Pass Data Roughing Mill

Max.Number of Records: 90

Record Length: 192 Byte

Unit: 1 record per material and pass in the roughing mill

Keys: - Slab Identification
- Pass Number

Record Creation Events: - start of pass in roughing mill

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                   +---------------------------------------+               */
/*******************|  DB ROW: ACTUAL ROLLING PASS DATA RM  |***************/
/*                   +---------------------------------------+               */
/*                                                                           */
/* DB access key:  SLI_SlabId                                                */
/*                 MDB_PasNo                                                 */
/* ------------------------------------------------------------------------- */
typedef struct                          /*                                   */
{                                       /*                                   */
  long             operMode;          /* operation mode:                   */
                                      /*     0 ... manual mode             */
                                      /*     1 ... level 1 mode            */
                                      /*     2 ... level 2 mode            */
  MDB_ActBlind     activeBlind;       /* active / blind pass indicator     */
                                      /* time schedule:                    */
                                      /* --------------                    */
  MDB_Abstim       timeStartPas;      /* date and time start of pass       */
  MDB_Abstim       timeEndPas;        /* date and time end of pass         */
  MDB_Deltim       rolTime;           /* rolling time                      */
                                      /* rolling data:                     */
                                      /* -------------                     */
  MDB_VMMfloat     aveEntryTemp;      /* average temperature RM entry side */
  MDB_VMMfloat     aveExitTemp;       /* average temperature RM exit side  */
  float            sigExitTemp;       /* standard deviation temp.RM exit side*/
  MDB_VMMfloat     aveForce;          /* average roll force                */
  MDB_VMMfloat     aveTorque;         /* average roll torque               */
  MDB_VMMfloat     aveSpeed;          /* average rolling speed             */
  MDB_VMMfloat     aveScrewDown;      /* average screw down                */
  MDB_VMMfloat     aveScrewDownOS;    /* average screw down operator side  */
  MDB_VMMfloat     aveScrewDownDS;    /* average screw down drive side     */
  float            edgAdjust;         /* actual edger adjust               */
                                      /*     -1 = not used (even pass)     */
  MDB_VMMfloat     current;           /* motor current [amp]               */
  MDB_VMMfloat     volt;              /* motor volts [volt]                */
  MDB_VMMfloat     descPressure;      /* descaling pressure                */
  long             rollCooling;       /* roll cooling (0 = OFF / 1 = ON)   */

  float            speedRMDT;         /* actual speed RMDT                 */
  float            lastLocation;      /* last rcvd location from L1 mea.data */
                                      /* used for calc. of roll footage    */
} MDB_AdatRMpass;                     /*                                   */
/*****************************************************************************/
```

2.8.5 Actual Pass Raw Data Roughing Mill

Max.Number of Records: 3600

Record Length: 68 Byte

Unit: 1 record per material and pass and segment

Keys:
- Slab Identification
- Pass Number
- Sequence number

Record Creation Events: - receive actual data

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                    +-----------------------------------+                 */
/*********************|  DB ROW: ACTUAL PASS RAW DATA RM  |*****************/
/*                    +-----------------------------------+                 */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                 MDB_PasNo                                                */
/*                 MDB_SeqNo                                                */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                          /*                                  */
{                                       /*                                  */
  MDB_SeqNo        seqNo;               /* sequence number                  */
                                        /*                                  */
                                        /* rolling data:                    */
                                        /* -------------                    */
  long             operMode;            /* operation mode:                  */
                                        /*     0 ... manual mode            */
                                        /*     1 ... level 1 mode           */
                                        /*     2 ... level 2 mode           */
  MDB_Deltim       timeStartPass;       /* time from start of pass          */
  float            matLoc;              /* material location                */
  float            entryTemp;           /* temperature RM entry side        */
  float            exitTemp;            /* temperature RM exit side         */
  float            forceOS;             /* roll force operator side         */
  float            forceDS;             /* roll force drive side            */
  float            torque;              /* roll torque                      */
  float            speed;               /* rolling speed                    */
  float            screwDown;           /* screw down                       */
  float            screwDownOS;         /* screw down operator side         */
  float            screwDownDS;         /* screw down drive side            */
  float            edgAdjust;           /* actual edger adjust              */
                                        /*     -1 = not used (even pass)    */
  float            current;             /* motor current [amp]              */
  float            volt;                /* motor volts [volt]               */
  float            descPressure;        /* descaling pressure               */
                                        /*                                  */
} MDB_AdatRMraw;                        /*                                  */
/****************************************************************************/
```

2.8.6 Actual General Rolling Data Finishing Mill

Max.Number of Records: 10

Record Length: 564 Byte

Unit: 1 record per material rolled in the finishing mill

Keys: - Slab Identification

Record Creation Events: - 1. finishing mill entry temperature received

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                +-----------------------------------------+              */
/*****************|  DB ROW: ACTUAL GENERAL ROLLING DATA FM  |***************/
/*                +-----------------------------------------+              */
/*                                                                         */
/* DB access key:  SLI_SlabId                                              */
/*                                                                         */
/* ----------------------------------------------------------------------- */
typedef struct                          /*                                 */
{                                       /* time schedule:                  */
                                        /* --------------                  */
  MDB_Abstim       timeStartRol;      /* date and time start of rolling at F1*/
  MDB_Abstim       timeEndRol;        /* date and time end of rolling at F6  */
  MDB_Deltim       rolTime;           /* rolling time                    */

  MDB_Abstim       timeStartCoil;     /* date and time start of coiling      */
  MDB_Abstim       timeEndCoil;       /* date and time end of coiling        */
  long             operMode;          /* operation mode:                 */
                                      /*     0 ... manual mode           */
                                      /*     1 ... level 1 mode          */
                                      /*     2 ... level 2 mode          */
                                      /*                                 */
                                      /* rolling data:                   */
                                      /* -------------                   */
  MDB_VMMfloat     aveExitThick;      /* average exit thickness (via AGC)    */
  float            sigExitThick;      /* standard dev. exit thickness        */
  MDB_VMMfloat     aveExitThickHead;  /* average exit thickness head         */
  MDB_VMMfloat     aveExitThickBody;  /* average exit thickness head         */
  MDB_VMMfloat     aveExitThickTail;  /* average exit thickness tail         */
  MDB_VMMfloat     aveExitThickABB;   /* average exit thickness (via ABB)    */
  float            sigExitThickABB;   /* standard dev. exit thickness        */
  MDB_VMMfloat     aveExitWidth;      /* average exit width                  */
  float            sigExitWidth;      /* standard deviation exit width       */
  MDB_VMMfloat     aveExitWidthHead;  /* average exit width head             */
  MDB_VMMfloat     aveExitWidthTail;  /* average exit width tail             */
  float            finalStripLen;     /* final strip length                  */
  MDB_VMMfloat     aveEntryTemp;      /* average temperature before F1       */
  float            sigEntryTemp;      /* standard deviation temp. F1 entry   */
  MDB_VMMfloat     aveExitTemp;       /* average temperature behind F6       */
  float            sigExitTemp;       /* standard deviation temp. F6 exit    */
  MDB_VMMfloat     aveExitTempHead;   /* average temperature behind F6 head  */
  MDB_VMMfloat     aveExitTempTail;   /* average temperature behind F6 tail  */
  MDB_VMMfloat     aveFinTemp;        /* average temperature before DC       */
```

```
  float            sigFinTemp;       /* standard deviation temp. before DC  */
  MDB_VMMfloat     aveFinTempHead;   /* average temperature before DC head  */
  MDB_VMMfloat     aveFinTempTail;   /* average temperature before DC tail  */
  MDB_VMMfloat     aveProfile;       /* average strip profile               */
  float            sigProfile;       /* standard deviation strip profile    */
  MDB_VMMfloat     aveWedge;         /* average wedge                       */
  float            sigWedge;         /* standard deviation wedge            */
  MDB_VMMfloat     aveEdgeDropOS;    /* average edge drop operator side     */
  float            sigEdgeDropOS;    /* standard deviation edge drop OS     */
  MDB_VMMfloat     aveEdgeDropDS;    /* average edge drop drive side        */
  float            sigEdgeDropDS;    /* standard deviation edge drop DS     */
  float            shapeFactor;      /* average shape factor [%]            */
                                     /*                                     */
                                     /* descaler:                           */
                                     /* ---------                           */
  float            adjPRoffset;      /* adjusted PR scale breaker offset    */
  MDB_PRdescale    PRdescale[2];     /* PR scale breaker descaling:         */
                                     /*         0 ... south                 */
                                     /*         1 ... north                 */
  float            descalePressure;  /* descale pressure                    */
                                     /* cooling:                            */
                                     /* --------                            */
  MDB_CoolPattern  coolPattern;      /* actual cooling pattern              */

                                     /* other finishing data:               */
                                     /* ---------------------               */
  float            meaWeight;        /* measured coil weight                */
  float            opeWeight;        /* entered coil weight                 */

                                     /* calculated data:                    */
                                     /* ----------------                    */
  MDB_VMMfloat     aveExitThickC;    /* average exit thickness              */
  float            sigExitThickC;    /* standard dev. exit thickness        */
  MDB_VMMfloat     aveExitWidthC;    /* average exit width                  */
  float            sigExitWidthC;    /* standard deviation exit width       */
  MDB_VMMfloat     aveExitTempC;     /* average temperature behind F6       */
  float            sigExitTempC;     /* standard deviation temp. F6 exit    */
  MDB_VMMfloat     aveProfileC;      /* average strip profile               */
  float            sigProfileC;      /* standard deviation strip profile    */
  MDB_VMMfloat     aveWedgeC;        /* average wedge                       */
  float            sigWedgeC;        /* standard deviation wedge            */
  MDB_VMMfloat     aveEdgeDropOSC;   /* average edge drop                   */
  float            sigEdgeDropOSC;   /* standard deviation edge drop        */
  MDB_VMMfloat     aveEdgeDropDSC;   /* average edge drop                   */
  float            sigEdgeDropDSC;   /* standard deviation edge drop        */
  MDB_VMMfloat     aveFinTempC;      /* average temperature before DC       */
  float            sigFinTempC;      /* standard deviation temp. before DC  */

  long             curLimitReached;  /* bitmap for current limit reached    */
                                     /*   bit 2**0  spare                   */
                                     /*   bit 2**1  stand F1                */
                                     /*   bit 2**2  stand F2                */
                                     /*   bit 2**3  stand F3                */
                                     /*   bit 2**4  stand F4                */
                                     /*   bit 2**5  stand F5                */
                                     /*   bit 2**6  stand F6                */
  long             manualSpeedCorr;  /* manual speed correction             */
                                     /*   -1 ... speed decrease             */
                                     /*    0 ... no correction              */
                                     /*    1 ... speed increase             */
} MDB_AdatFMgeneral;                 /*                                     */
/*************************************************************************/
```

2.8.7 Actual Stand Specific Rolling Data Finishing Mill

Max.Number of Records: 60

Record Length: 262 Byte

Unit: 1 record per material and stand

Keys: - Slab Identification
- Stand number

Record Creation Events: - start of rolling in finishing mill

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*             +-------------------------------------------------+          */
/**************|  DB ROW: ACTUAL STAND SPECIFIC ROLLING DATA FM  |**********/
/*             +-------------------------------------------------+          */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                 MDB_StandNo                                              */
/*                                                                          */
/* ------------------------------------------------------------------------ */

typedef struct                      /* data of actual installed roll       */
{                                   /* ----------------------------------- */
  ROI_RollId       rollId;          /* roll ID                             */
  float            diameter;        /* roll diameter                       */
  float            bearingRad;      /* bearing radius                      */
  float            youngsMod;       /* young's elasticity modulus          */
  float            poisRatio;       /* poission's ratio                    */
  float            crown;           /* roll crown (from rollInvR1)         */
} MDB_ActRollData;                  /* ----------------------------------- */

typedef struct                      /*                                     */
{                                   /* actual values:                      */
                                    /* --------------                      */
  MDB_VMMfloat     aveScrewDownOS;  /* average screw down operator side    */
  MDB_VMMfloat     aveScrewDownDS;  /* average screw down drive side       */
  MDB_VMMfloat     aveLoadGap;      /* average load gap                    */
  MDB_VMMfloat     aveSpeed;        /* average speed of main drive         */
  MDB_VMMfloat     aveForce;        /* average roll force                  */
  float            sigForce;        /* standard deviation roll force       */
  MDB_VMMfloat     aveForceOS;      /* average roll force Operator Side    */
  float            sigForceOS;      /* standard deviation roll force OS    */
  MDB_VMMfloat     aveForceDS;      /* average roll force Drive Side       */
  float            sigForceDS;      /* standard deviation roll force DS    */
  MDB_VMMfloat     aveTorque;       /* average roll torque                 */
  float            sigTorque;       /* standard deviation roll torque      */
  MDB_VMMfloat     aveCurrent;      /* average motor current               */
  MDB_VMMfloat     aveVolt;         /* average motor volts                 */

  short            seqNoAGCoverload; /* sequence no. from raw data when AGC */
                                    /* overload was reached:               */
                                    /*    0 ... no AGC overload            */
```

```
  short            seqNoCurrentLimit;/* sequence no. from raw data when     */
                                     /* curr.lim was reached:               */
                                     /*    0 ... no current limit reached   */

  float            lastLocation;     /* last rcvd location from L1 mea.data */
                                     /* used for calc. of roll footage      */

                                     /* ---------------------------------- */
                                     /* following data are set at end of    */
                                     /* rolling in RM:                      */
  MDB_ActRollData  rollData          /* data of actual installed rolls:     */
                 [MDB_dMaxRollType]  /* index 1: MDB_RollType_e  (WR or BR) */
                 [MDB_dMaxPosType];  /* index 2: MDB_PosType_e (top or bot) */
  float            myFrict;          /* friction coeff. backuproll-bearing  */
                                     /* ---------------------------------- */
  short            manualGapChange;  /* gap manually changed (Y/N = 1/0)    */
                                     /*                                     */
} MDB_AdatFMstand;                   /*                                     */
/*************************************************************************/
```

2.8.8 Actual Stand Specific Rolling Raw Data Finishing Mill

Max.Number of Records: 39000

Record Length: 84 Byte

Unit: 1 record per strip segment for each stand

Keys:
- Slab Identification
- Stand number
- Sequence number

Record Creation Events: - receive actual data

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*           +-------------------------------------------------+        */
/************|  DB ROW: ACTUAL STAND SPECIFIC ROLLING RAW DATA FM  |*********/
/*           +-------------------------------------------------+        */
/*                                                                       */
/* DB access key:  SLI_SlabId                                            */
/*                 MDB_StandNo                                           */
/*                 MDB_SeqNo                                             */
/*                                                                       */
/* --------------------------------------------------------------------- */
typedef struct                      /*                                   */
{                                   /* actual values:                    */
                                    /* --------------                    */
  MDB_Deltim       delTime;         /* delta time since strip in stand   */
  float            current;         /* motor current [amp]               */
  float            volt;            /* motor volt [volt]                 */
  float            looperAngle;     /* actual looper angle [deg]         */
} MDB_ActABBdata;                   /*                                   */

typedef struct                      /*                                   */
{                                   /*                                   */
  MDB_SeqNo        seqNo;           /* sequence number                   */
                                    /*                                   */
                                    /* actual values (AGC data):         */
                                    /* -------------------------         */
  float            location;        /* strip location                    */
  MDB_Deltim       delTime;         /* delta time since strip in stand   */
  float            exitThick;       /* exit thickness                    */
  float            entryThick;      /* entry thickness                   */
  float            screwDownOS;     /* screw down operator side          */
  float            screwDownDS;     /* screw down drive side             */
  float            speed;           /* rolling speed                     */
  float            forceOS;         /* roll force operator side          */
  float            forceDS;         /* roll force drive side             */
  float            torque;          /* roll torque                       */
  float            thick;           /* X-Ray thickness                   */
  float            entryTemp;       /* calculated entry temperature      */
  float            thermCrown;      /* thermal crown (Index 0)           */
  long             measValid;       /* flag: temp. value is valid or not */
  float            monFeedBack;     /* monitor feedback [in]             */
```

```
  long             stateBitmap;      /* state bitmap (0 = OFF / 1 = ON)     */
                                     /*   bit                               */
                                     /*   2**0    monitor loop ON/OFF       */
                                     /*   2**1    gap manually changed      */
                                     /*   2**2    WESTON gauge used         */
                                     /*   2**3    DMC gauge used            */
                                     /*   2**4    AGC overload reached      */
                                     /*   2**5    175% current limit reached*/
                                     /*                                     */
  MDB_ActABBdata   ABB;              /* data from ABB PLC                   */
                                     /*                                     */
} MDB_AdatFMrawStand;                /*                                     */
/*************************************************************************/
```

2.8.9 Actual Entry Raw Data Finishing Mill

Max.Number of Records: 2500

Record Length: 20 Byte

Unit: 1 record per material and TB segment

Keys: - Slab Identification
- Sequence number

Record Creation Events: - receive measurement values

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                   +-------------------------------------+                   */
/*******************|  DB ROW: ACTUAL ENTRY RAW DATA FM   |*******************/
/*                   +-------------------------------------+                   */
/*                                                                             */
/* DB access key:  SLI_SlabId                                                  */
/*                 MDB_SeqNo                                                   */
/*                                                                             */
/* --------------------------------------------------------------------------- */
typedef struct                          /*                                     */
{                                       /*                                     */
  MDB_SeqNo        seqNo;               /* sequence number                     */
                                        /*                                     */
                                        /* actual values:                      */
                                        /* --------------                      */
  float            speedRT;             /* speed of roller table RMDT          */
  MDB_Deltim       timeTBhead;          /* time since TB head entered pyrometer*/
  float            temp;                /* temperature before F1               */
  float            calcLocation;        /* calulated transfer bar location     */
                                        /*                                     */
} MDB_AdatFMrawEntry;                   /*                                     */
/*****************************************************************************/
```

2.8.10 Actual Exit Raw Data Finishing Mill

Max.Number of Records: 2500

Record Length: 48 Byte

Unit: 1 record per material and strip segment

Keys: - Slab Identification
- Sequence number

Record Creation Events: - receive measurement values

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                   +-----------------------------------+                    */
/*******************|  DB ROW: ACTUAL EXIT RAW DATA FM  |********************/
/*                   +-----------------------------------+                    */
/*                                                                            */
/* DB access key:  SLI_SlabId                                                 */
/*                 MDB_SeqNo                                                  */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /*                                    */
  MDB_SeqNo         seqNo;              /* sequence number                    */
                                        /*                                    */
                                        /* actual values:                     */
                                        /* --------------                     */
  MDB_Deltim        delTime;            /* delta time since head in pyrometer */
  float             location;           /* strip location                     */
  float             thick;              /* X-Ray thickness                    */
  float             width;              /* width gauge                        */
  float             temp;               /* strip temperature behind F6        */
  float             profile;            /* strip profile                      */
  float             wedge;              /* wedge                              */
  float             edgeDropOS;         /* edge drop operator side            */
  float             edgeDropDS;         /* edge drop drive side               */
  float             devCentLine;        /* center line deviation              */
  float             shapeFactor;        /* shape factor [%]                   */
                                        /*                                    */
} MDB_AdatFMrawExit;                    /*                                    */
/****************************************************************************/
```

2.8.11 Actual Finishing Raw Data Finishing Mill

Max.Number of Records: 3500

Record Length: 16 Byte

Unit: 1 record per material and strip segment

Keys: - Slab Identification
- Sequence number

Record Creation Events: - receive measurement values

Record Deletion Events: - deletion of related *Primary Data Record*

```
/*                 +---------------------------------------+                */
/*****************|  DB ROW: ACTUAL FINISHING RAW DATA FM  |*****************/
/*                 +---------------------------------------+                */
/*                                                                          */
/* DB access key:  SLI_SlabId                                               */
/*                 MDB_SeqNo                                                */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                      /*                                      */
{                                   /*                                      */
  MDB_SeqNo        seqNo;           /* sequence number                      */
                                    /*                                      */
                                    /* actual values:                       */
                                    /* --------------                       */
  MDB_Deltim       delTime;         /* delta time since head in pyrometer   */
  float            location;        /* strip location                       */
  float            temp;            /* coiling temperature                  */
                                    /*                                      */
} MDB_AdatFMrawFinish;              /*                                      */
/****************************************************************************/
```

2.9 Model Data

2.9.1 General Model Data

Max.Number of Records: 1

Record Length: 1104 Byte

Unit: 1 permanent record

Keys: none

Record Creation Events: - none

Record Deletion Events: - none

```
/*                              +-------------+                               */
/*******************************|  Distances  |*******************************/
/*                              +-------------+                               */
typedef struct                        /* all distances are related to F1     */
{                                     /* (roll gap);                         */
                                      /* distances to other roll stands are  */
                                      /* related to the corresponding roll   */
                                      /* gap                                 */
                                      /*                                     */
  float           pyrRMentry;         /* pyrometer RM entry side             */
  float           RM;                 /* RM stand                            */
  float           pyrRMexit;          /* pyrometer RM exit side              */
  float           tableCoverStart;    /* table cover start                   */
  float           tableCoverEnd;      /* table cover end                     */
  float           pyrFMentry;         /* pyrometer FM entry side             */
  float           PRstart;            /* PR scale breaker start              */
  float           PRend;              /* PR scale breaker end                */
  float           F2;                 /* F2 stand                            */
  float           F3;                 /* F3 stand                            */
  float           F4;                 /* F4 stand                            */
  float           F5;                 /* F5 stand                            */
  float           F6;                 /* F6 stand                            */
  float           pyrFMexit;          /* pyrometer FM exit side              */
  float           thickProfDev;       /* thickness/profile measurement device*/
  float           widthDev;           /* width measurement device            */
  float           pyrDCentry;         /* pyrometer DC entry side             */
  float           distCoolF1Start;    /* distance F1-Interstd.Cooling Start  */
  float           distCoolF1End;      /* distance F1-Interstd.Cooling End    */
  float           distCoolF2Start;    /* distance F2-Interstd.Cooling Start  */
  float           distCoolF2End;      /* distance F2-Interstd.Cooling End    */
  float           distCoolF3Start;    /* distance F3-Interstd.Cooling Start  */
  float           distCoolF3End;      /* distance F3-Interstd.Cooling End    */
                                      /*                                     */
} MDB_DistancesF1;                    /*                                     */
/*****************************************************************************/
```

```
/*                          +--------------------+                          */
/**************************|  HEAT COVER MODEL  |**************************/
/*                          +--------------------+                          */
typedef struct                      /*                                      */
{                                   /*                                      */
                                    /*                                      */
  float           tempShield;       /* shield temperature heat cover        */
  float           tempWallTop;      /* top temprature wall                  */
  float           tempWallMean;     /* mean temperature wall                */
                                    /*                                      */
} MDB_MdatCover;                    /*                                      */
/*****************************************************************************/

/*                        +------------------------+                        */
/************************|  THICKNESS CORRECTION  |************************/
/*                        +------------------------+                        */
typedef struct                      /*                                      */
{                                   /*                                      */
                                    /*                                      */
  long            thickFlag;        /* 0 - thickness correction off         */
                                    /* 1 - thickness correction on          */
  float           actThickOffset;   /* actual thickness offset              */
  float           globThickLearn;   /* learning rate                        */
  float           reqThickOffset;   /* requested thickness offset           */
  float           globThickMax;     /* upper limit thickness deviation      */
  float           globThickMin;     /* lower limit thickness deviation      */
  float           sysThickMax;      /* upper limit syst. thickness corr.    */
  float           sysThickMin;      /* lower limit syst. thickness corr.    */
                                    /*                                      */
} MDB_MdatThick;                    /*                                      */
/*****************************************************************************/

/*                          +--------------------+                          */
/**************************|  MATERIAL CLASSES  |**************************/
/*                          +--------------------+                          */
typedef struct                      /*                                      */
{                                   /*                                      */
                                    /* for following 3 data (nClass...)     */
                                    /* the maximum is MDB_dMaxClass:        */
  long        nClassWidth;          /* actual no. of width classes          */
  long        nClassLength;         /* actual no. of length classes         */
  long        nClassThick;          /* actual no. of thickness classes      */
  float       width [MDB_dMaxClass]; /* upper class limit for width         */
  float       length[MDB_dMaxClass]; /* upper class limit for length        */
  float       thick [MDB_dMaxClass]; /* upper class limit for thickness     */
                                    /*                                      */
} MDB_MdatClass;                    /*                                      */
/*****************************************************************************/
```

```
/*                      +------------------------------+                      */
/**********************|  DB ROW: GENERAL MODEL DATA  |**********************/
/*                      +------------------------------+                      */
/*                                                                            */
/* DB access key:  none                                                       */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{
  short       standMap                  /* stand map (indication dummy stands) */
                 [MDB_dNoStand];        /* 0 ... dummy stand / 1 = active stand*/

                                        /* switches & states: 0 = OFF, 1 = ON  */
                                        /* ---------------------------------- */
  short       stateFMcalc;              /* calculation                        */
  short       stateFMrecalc;            /* recalculation                      */
  short       stateAda;                 /* ALL adaptions ON/OFF               */
  short       stateAdaForceTorque;      /* Adaption Force / Torque            */
  short       stateAdaThick;            /* Adaption Thickness                 */
  short       stateAdaTemp;             /* Adaption Temperature               */
  short       stateAdaWidth;            /* Adaption Width                     */
  short       stateAdaSpeed;            /* Adaption Speed                     */
                                        /* ---------------------------------- */

  short       strategyMode;             /* strategy mode:                     */
                                        /*    0 ... force strat.              */
                                        /*    1 ... load strat.               */

  short       autoPrintProtocol;        /* automatic print for protocol:      */
                                        /*    0 ... OFF                       */
                                        /*    1 ... ON                        */

  long        tailCalcOn;               /* tailend calculation ON/OFF         */
                                        /* calcSameSpeed  FIZZ...             */

  long        crownOn;                  /* crown ON/OFF                       */
  long        gapCorrOn;                /* gap correction ON/OFF              */

                                        /* learning memory                    */
                                        /* ---------------                    */
  float            rateShort;           /* learn. rate for stateAdaForceTorque */
  float            rateLong1;           /* learning rate for state[1],        */
                                        /* if adaMethod = 1                   */
  float            rateLong2;           /* memory for state[1],               */
                                        /* if adaMethod = 2                   */
  float            rateLongM4;          /* learning rate for m4, if adaMethod=2*/
  float            rateTemp;            /* learning rate for state[2]         */
  float            rateThick;           /* learning rate for state[3]         */
  float            rateWidth;           /* learning rate for state[4]         */
                                        /*                                    */
                                        /* limitations                        */
                                        /* -----------                        */
  float            adaTempMin;          /* Min. adaptor for state[2]          */
  float            adaTempMax;          /* Max. adaptor for state[2]          */
  float            adaTempTotMin;       /* Min. Temperature adaptor           */
  float            adaTempTotMax;       /* Max. Temperature adaptor           */
  float            adaStCoolMin;        /* Min. Temp. adaptor with cooling    */
  float            adaStCoolMax;        /* Max. Temp. adaptor with cooling    */
  float            adaThickMin;         /* Min. adaptor for state[3]          */
  float            adaThickMax;         /* Max. adaptor for state[3]          */
  float            adaWidthMin;         /* Min. adaptor for state[4]          */
  float            adaWidthMax;         /* Max. adaptor for state[4]          */
                                        /*                                    */
  float            logYieldBreak;       /* Residual limitation for log. yield */
                                        /* stress, if adaMethod = 2           */
  float            torqueBreak;         /* Residual limitation for roll torque,*/
```

```
                                    /* if adaMethod = 2                    */
                                    /*                                     */
                                    /* actual adaptors (no dependence)     */
                                    /* ---------------                     */
float           adaTempAct;         /* actual temperature adaptor          */
float           adaTempPrev;        /* previous temperature adaptor        */
float           adaThickAct;        /* actual gaugemeter adaptor           */
float           adaThickPrev;       /* previous gaugemeter adaptor         */
float           adaWidthAct;        /* actual width adaptor                */
float           adaWidthPrev;       /* previous width adaptor              */
float           adaThickOper;       /* thickness adaptor operator          */
                                    /*                                     */
MDB_MdatThick   mdatThick;          /* thickness correction                */
                                    /*                                     */
                                    /* distances:                          */
                                    /* ----------                          */
MDB_DistancesF1 distF1;             /* related to F1                       */
                                    /*                                     */
MDB_MdatCover   mdatCover;          /* heat cover data                     */
                                    /*                                     */
                                    /* speed values:                       */
                                    /* -------------                       */
float           defSpeedRMlast;     /* default speed last pass RM          */
float           actSpeedRMFM;       /* actual speed RM to FM               */
float           defSpeedRMFM;       /* default speed RM to FM              */
float           defSpeedDescale;    /* default descaling speed             */
                                    /*                                     */
                                    /* general:                            */
                                    /* --------                            */
float           maxReduction        /* maximal reduction for all stands    */
                  [MDB_dNoStand];
float           devShape            /* allowed shape deviation [%]         */
                  [MDB_dNoStand];
float           biteAngle;          /* bite angle                          */
float           relTolForceRad;     /* rel.tolerance force/radius iteration*/
long            maxIterForceRad;    /* max.iterations force/radius comp.   */
float           aveTempWR;          /* average temperature of work rolls   */
long            n;                  /* number of work roll slizes          */
float           tempAmbTop;         /* ambient temperature top             */
float           tempAmbBot;         /* ambient temperature bottom          */
float           tempWater;          /* water temperature                   */
float           alphaAir;           /* heat transfer roll<->air            */
float           alphaWater;         /* heat transfer roll<->water          */
float           timeStep;           /* time step of iteration              */
float           tempAmbBotCov;      /* ambient temperature bottom cover    */
float           tempAmbTopRMDT;     /* ambient temperature top RMDT        */
float           tempAmbBotRMDT;     /* ambient temperature bottom RMDT     */
                                    /*                                     */
                                    /* heat cover - shield                 */
                                    /* -------------------                 */
float           thickShield;        /* shield thickness                    */
float           lambdaShield;       /* thermal conductivity shield         */
float           cShield;            /* spec. heat capacity shield          */
float           rhoShield;          /* denstity shield                     */
float           emisShield;         /* emissivity shield                   */
                                    /*                                     */
                                    /* heat cover - wall                   */
                                    /* -----------------                   */
float           thickWall;          /* wall thickness                      */
float           lambdaWall;         /* thermal conductivity wall           */
float           rhoWall;            /* density wall                        */
float           cWall;              /* spec. heat capacity wall            */
float           alphaWall;          /* heat transfer wall<->air            */
                                    /*                                     */
float           timeStepCover;      /* time step for heat cover model      */
float           cyclCover;          /* cycle time heat cover model         */
```

```
float           timeStepCrown;    /* time step thermal crown model       */
float           cyclCrown;        /* cycle time thermal crown model      */
long            nApprox;          /* number of points for approximation  */
                                  /* of thermal crown                    */
float           wearCoeff[MDB_dNoStand];/* wear coefficient              */
long            nPoly[MDB_dNoStand];    /* polynomial degree calibration */
                                  /* 1,2,3,4 or                          */
                                  /* -1..automatic determination         */
float           widthCool;        /* width of interstand cooling         */
float           flowRateF1F2;     /* flow rate of interstand cooling F1F2*/
float           flowRateF2F3;     /* flow rate of interstand cooling F2F3*/
float           flowRateF3F4;     /* flow rate of interstand cooling F3F4*/
float           widthScBr;        /* width of scale breaker              */
float           flowRateScBr;     /* flow rate scale breaker             */
float           offPosEntrySG;    /* offset position stand entry side    */
                                  /* guide                               */
float           offsetPR;         /* pinch roll scale braker side guide  */
                                  /* offset                              */
float           minRadWrRM;       /* min. work roll radius RM            */
float           maxRadWrRM;       /* max. work roll radius RM            */
float           speedPR;          /* speed pinch roll scale breaker      */
float           specForceRM;      /* spec. roll force RM                 */
float           rateTempTot;      /* learning rate for state [2]         */
float           rateTempStCool;   /* learning rate for state [2]         */
                                  /* interstand cooling ON               */
float           adaTempTotAct;    /* actual temperature adaptor          */
float           adaStCoolAct;     /* actual temperature adaptor          */
                                  /* interstand cooling ON               */
float           adaTempTotPrev;   /* previous temperature adaptor        */
float           adaStCoolPrev;    /* previous temperature adaptor        */
                                  /* interstand cooling ON               */
float           forceUtility;     /* roll force utility [%]              */
long            nMeasRec;         /* number of valid measurements for    */
                                  /* recalculation                       */
long            firstMeasRec;     /* first valid measurement record      */
float           alphaWaterF13;    /* alpha water F1 to F3                */
float           alphaWaterF46;    /* alpha water F4 to F6                */
float           alphaWaterF13_idle;/* alpha water F1 to F3               */
float           alphaWaterF46_idle;/* alpha water F4 to F6               */
float           stretchCorrRM;    /* stretch correction RM               */

float           corrRad;          /* correction factor radiation    [-]  */
float           corrCool;         /* correction factor cooling      [-]  */
float           corrDeform;       /* correction factor deformation  [-]  */
float           corrCover;        /* correction table cover radiat. [-]  */
float           corrTrans;        /* correction table heat transisio[-]  */
MDB_VMMfloat    adaTrbTim;        /* adaptor time of Transfer in RMDT[s] */
MDB_VMMfloat    adaStandLim;      /* Limits for force adaptors stand[-]  */
MDB_VMMfloat    adaForceGenLim;   /* Limits for force adaptors general[-]*/
MDB_VMMfloat    adaTorquGenLim;   /* Limits for torque adaptor        [-]*/
long            firstRecAda;      /* Number of records for adaption      */
long            nMeasRecAda;      /* Number of records for adaption      */

float           speedCorr[MDB_dNoStand];    /* speed correction factor   */
float           speedCorrMin[MDB_dNoStand]; /* speed correction min.     */
float           speedCorrMax[MDB_dNoStand]; /* speed correction max.     */
long            speedCorrState;             /* speed corr. ON/OFF 1/0    */
float           rateSpeedCorr;              /* learning rate speed corr. */
long            strategyPreset;             /* strategy presetting       */

float           forceF6min;                 /* min force F6              */
float           maxLenClass1;               /* max length of class 1     */
float           maxLenClass2;               /* max length of class 2     */
float           corrSpecSlope;              /* correction factor         */
float           corrSpecSlopeClass1;        /* correction factor class 1 */
float           corrSpecSlopeClass2;        /* correction factor class 2 */
```

```
  float            speedOffset;              /* speed offset              */

  long             stateWeston;              /* WESTON gauge ON/OFF (1/0) */
  long             leadStand;                /* lead stand                */

  float            speedOffsetReq;           /* requested speed offset    */
  float            timeStartHead;            /* Time from head [s]        */
  float            timeEndHead;              /* Time last seg  [s]        */
  long             pyrometerRMused;          /* 0 ... none                */
                                             /* 1 ... north               */
                                             /* 2 ... south               */
                                             /* 3 ... both                */
  long             limitCheckOn;             /* load strategy limit check */
                                             /* ON/OFF  1/0               */

                                             /* temperature deviation RM: */
  float            tempDevLearn;             /*   learning rate           */
  float            tempDevPrev[2];           /*   previous (south/north)  */
  float            tempDevAct[2];            /*   actual (south/north)    */
  float            tempDevMin;               /*   minimum                 */
  float            tempDevMax;               /*   maximum                 */
  float            distRevers;               /* distance RM gap to head on*/
                                             /* revers. pass              */

  MDB_MdatClass    matClass;                 /* material classes          */

  float            fReserved[6];             /* float spare               */
                                             /* 0 ... tension fact. carbon*/
                                             /* 1 ... tension fact. stainl*/
                                             /* 2 ... force grad.correctn */
                                             /* 3 ... % speed red. F6     */
                                             /* 4 ... spare               */
                                             /* 5 ... spare               */

  long             lReserved[6];             /* long spare                */
                                             /* 0 ... draft change in frc.*/
                                             /*       strategy allowed    */
                                             /* 1 ... force gradient ON   */
                                             /* 2 ... long term ada ON    */
                                             /* 3 ... mod$exe:pp ON       */
                                             /* 4 ... gap correction ON   */
                                             /* 5 ... wear model ON       */
                                             /*                           */
} MDB_MdatGeneral;                           /*                           */
/*****************************************************************************/
```

2.9.2 Steel Grade Reference Table

Max.Number of Records: 200

Record Length: 40 Byte

Unit: 1 record per steel grade

Keys: - steel grade

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                  +---------------------------------------+                 */
/******************|  DB ROW: STEEL GRADE REFERENCE TABLE  |*****************/
/*                  +---------------------------------------+                 */
/*                                                                            */
/* DB access key:  MDB_Grade                                                  */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /* reference values:                  */
                                        /* -----------------                  */
  long             codeMatLaw;        /* material law code                  */
  long             codeMatProp;       /* material property code             */
  long             codeDescale;       /* descale code                       */
  long             codeIntCool;       /* interstand cooling code            */
  long             codeLooperStrat;   /* looper strategy code               */
  long             codeRolStrat;      /* rolling strategy code              */
  long             codeMatClass;      /* material class code                */
                                        /*                                    */
                                        /* SRT class specific data:           */
                                        /* -----------------------            */
  long             SRTclassRM;        /* class for RM SRT's                 */
  long             SRTclassFM;        /* class for FM SRT's                 */
  long             SRTclassCO;        /* class for cooling SRT's            */
                                        /*                                    */
} MDB_MdatSteelGrade;                   /*                                    */
/****************************************************************************/
```

2.9.3 Material Law Table

Max.Number of Records: 200

Record Length: 282 Byte

Unit: 1 record per material law code

Keys: - material law code

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                      +---------------------------------+                   */
/**********************|  MATERIAL LAW - MATERIAL DATA  |********************/
/*                      +---------------------------------+                   */
typedef struct                        /*                                     */
{                                     /*                                     */
  SLI_SlabId       slabId;            /* slab identification                 */
                                      /*                                     */
                                      /* material law:                       */
                                      /* -------------                       */
  float            coeGeneral;        /* general coefficient                 */
  float            coeTemp;           /* temperature coefficient             */
  float            coeSpeed;          /* speed coefficient                   */
  float            coeStrain;         /* strain coefficient                  */
  float            coeTorque;         /* torque coefficient                  */
                                      /*                                     */
                                      /* information values:                 */
                                      /* -------------------                 */
  float            pForce[4][4];      /* force information matrix 4x4        */
  float            pTorque;           /* torque information value            */
                                      /*                                     */
                                      /* stand adaptors:                     */
                                      /* ---------------                     */
  float            standAda[6];       /* stand adaptors 1 - 6                */
                                      /*                                     */
} MDB_MatLawMatDat;                   /*                                     */
/*************************************************************************/
```

```
/*                      +------------------------------+                      */
/**********************|  DB ROW: MATERIAL LAW TABLE  |**********************/
/*                      +------------------------------+                      */
/*                                                                            */
/* DB access key:  material law code (I4)                                     */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                          /*                                    */
{                                       /* general data                       */
  float            standAdaMin;         /* stand adaptor minimum value        */
  float            standAdaMax;         /* stand adaptor maximum value        */
                                        /*                                    */
  MDB_MatLawMatDat prvMat;              /* data for previous material         */
  MDB_MatLawMatDat actMat;              /* data for actual material           */
                                        /*                                    */
  float            adaTempAct;          /* actual temperature adaptor         */
  float            adaTempPrv;          /* previous temperature adaptor       */
  long             nTempAda;            /* no. of adaptions                   */
                                        /*                                    */
  float            coeTorque            /* torque coefficients for each stand */
                      [MDB_dNoStand];/*                                       */
                                        /*                                    */
} MDB_MdatMatLaw;                       /*                                    */
/****************************************************************************/
```

2.9.4 Material Property Table

Max.Number of Records: 20

Record Length: 1048 Byte

Unit: 1 record per material property code

Keys: - material property code

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*               +-----------------------------------------+               */
/****************|  MATERIAL PROPERTY - MATERIAL ITEM TABLE  |***************/
/*               +-----------------------------------------+               */
typedef struct                      /*                                     */
{                                   /*                                     */
  float            temp;            /* temperature                         */
  float            val;             /* temperature related value           */
} MDB_MatPropTV;                    /*                                     */
                                    /*                                     */
typedef struct                      /*                                     */
{                                   /*                                     */
  long             nPoint;          /* number of supporting points         */
  MDB_MatPropTV    t[30];           /* temp/value table                    */
                                    /*                                     */
} MDB_MatPropItem;                  /*                                     */
/*************************************************************************/


/*                   +-----------------------------------+                 */
/*******************|  DB ROW: MATERIAL PROPERTY TABLE  |******************/
/*                   +-----------------------------------+                 */
/*                                                                         */
/* DB access key:  material property code (I4)                             */
/*                                                                         */
/* ----------------------------------------------------------------------- */
typedef struct                      /*                                     */
{                                   /*                                     */
  MDB_MatPropItem  matDens;         /* material density                    */
  MDB_MatPropItem  matHeatCap;      /* material specific heat capacity     */
  MDB_MatPropItem  matCond;         /* material conductivity               */
  MDB_MatPropItem  matExpans;       /* material thermal expansion          */
  float            matEmisTop;      /* material emissivity top             */
  float            matEmisBot;      /* material emissivity bottom          */
  float            alphaCoeff[12];  /* heat transfer polynomial            */
                                    /* coefficients                        */
                                    /*                                     */
                                    /* material properties of scale        */
  float            scaleAveDens;    /* average density                     */
  float            scaleAveHeatCap; /* average specific heat capacity      */
  float            scaleAveCond;    /* average heat conductivity           */
  float            scaleAveThick;   /* average thickness                   */
                                    /*                                     */
```

```
} MDB_MdatMatProp;                  /*                                          */
/*******************************************************************************/
```

2.9.5 Descale Table

Max.Number of Records: 50

Record Length: 16 Byte

Unit: 1 record per descale code

Keys: - descale code

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                          +--------------------------+                        */
/*************************|  DB ROW: DESCALE TABLE   |************************/
/*                          +--------------------------+                        */
/*                                                                              */
/* DB access key:  descale code (I4)                                            */
/*                                                                              */
/* ---------------------------------------------------------------------------- */
typedef struct                          /*                                      */
{                                       /*                                      */
  MDB_PRdescale    PRdescale[2];        /* PR scale breaker descaling:          */
                                        /*          0 ... south                 */
                                        /*          1 ... north                 */
                                        /*                                      */
} MDB_MdatDescale;                      /*                                      */
/******************************************************************************/
```

2.9.6 Interstand Cooling Table

Max.Number of Records: 200

Record Length: 24 Byte

Unit: 1 record per interstand cooling code

Keys: - interstand cooling code

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                    +-------------------------------------+                 */
/*********************|  DB ROW: INTERSTAND COOLING TABLE   |*****************/
/*                    +-------------------------------------+                 */
/*                                                                            */
/* DB access key:  interstand cooling code (I4)                               */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                        /*                                      */
{                                     /*                                      */
  long              codeF1F2;         /* code for cooling between F1 - F2     */
  MDB_Deltim        timeF1F2ON;       /* duration of cooling between F1 - F2  */
                                      /*                                      */
  long              codeF2F3;         /* code for cooling between F2 - F3     */
  MDB_Deltim        timeF2F3ON;       /* duration of cooling between F2 - F3  */
                                      /*                                      */
  long              codeF3F4;         /* code for cooling between F3 - F4     */
  MDB_Deltim        timeF3F4ON;       /* duration of cooling between F3 - F4  */
                                      /*                                      */
} MDB_MdatIntCool;                    /*                                      */
/*****************************************************************************/
```

2.9.7 Looper Strategy Table

Max.Number of Records: 900

Record Length: 56 Byte

Unit: 1 record per looper strategy code

Keys: - looper strategy code

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                      +-------------------------------+                     */
/***********************|  LOOPER STRATEGY HELP TABLE   |*********************/
/*                      +-------------------------------+                     */
typedef struct                        /*                                     */
{                                     /*                                     */
  float            specStripTens;     /* specific strip tension              */
  float            angle;             /* looper angle                        */
                                      /*                                     */
} MDB_LooperTab;                      /*                                     */
/*****************************************************************************/

/*                     +---------------------------------+                   */
/*********************|  DB ROW: LOOPER STRATEGY TABLE  |*********************/
/*                     +---------------------------------+                   */
/*                                                                           */
/* DB access key:  looper strategy code (I4)                                 */
/*                 thickness min/max                                         */
/*                 width min/max                                             */
/*                                                                           */
/* ------------------------------------------------------------------------- */
typedef struct                        /*                                     */
{                                     /*                                     */
  MDB_LooperTab    looper[5];         /* table for looper 1 to 5             */
                                      /*                                     */
  float            adaWidthAct;       /* actual width adaptor                */
  float            adaWidthPrev;      /* prev. width adaptor                 */
  float            adaThickAct;       /* actual thickness adaptor            */
  float            adaThickPrev;      /* prev. thickness adaptor             */
                                      /*                                     */
} MDB_MdatLooperStrat;                /*                                     */
/*****************************************************************************/
```

2.9.8 Rolling Strategy Table

Max.Number of Records: 900

Record Length: 228 Byte

Unit: 1 record per rolling strategy code and width range and thickness range

Keys:
- rolling strategy code
- strip width
- strip thickness

Record Creation Events: - manual creation

Record Deletion Events: - manual deletion

```
/*                    +-----------------------------------+                    */
/********************|  DB ROW: ROLLING STRATEGY TABLE  |********************/
/*                    +-----------------------------------+                    */
/*                                                                             */
/* DB access key:  rolling strategy code (I4) or SRTclass (I4)                 */
/*                 thickness min/max                                           */
/*                 width min/max                                               */
/* --------------------------------------------------------------------------- */
typedef struct                        /*                                       */
{                                     /*                                       */
  long             nMaterials;        /* number of rolled materials           */
  float            specMaxForce;      /* specific maximum roll force          */
  float            specTgtForceF6;    /* spec.target roll force for stand F6  */
  float            specSlope;         /* specific slope shape control         */
  float            maxThickRed;       /* maximum thickness reduction          */
  float            maxBiteAngle;      /* maximum bite angle                   */
                                      /*                                      */
                                      /* SRT specific data:                   */
                                      /* ------------------                   */
  MDB_RecipeNo     refRecipeNoRM;     /* reference recipe number for RM       */
  MDB_RecipeNo     refRecipeNoFM;     /* reference recipe number for FM       */
  MDB_RecipeNo     refRecipeNoCO;     /* reference recipe number for Cooling  */
                                      /*                                      */
  float            maxReduction[MDB_dNoStand]; /* max. reduction             */
  long             disType[MDB_dNoStand];      /*                            */
  float            powerRel[MDB_dNoStand];     /*                            */
                                      /*                                      */
  float            epsPerc            /* percentage reduction for each stand */
                      [MDB_dNoStand];
  float            epsPercOper        /* percentage reduction (result from   */
                      [MDB_dNoStand];/* operator correction values)          */
  float            absCorrOper        /* absolute correction values from     */
                      [MDB_dNoStand];/* operator                            */
  float            fReserved1[6];     /* reserved                            */
  float            fReserved2[6];     /* reserved                            */
                                      /*                                      */
} MDB_MdatRolStrat;                   /*                                      */
```

/***/

2.9.9 Roll Geometry Characteristic

Max.Number of Records: 100

Record Length: 20 Byte

Unit: 1 record per stand and roll type

Keys: - roll geometry code

Record Creation Events: - manual creation

Record Deletion Events: - none

```
/*                                                                          */
/*                  +---------------------------------------+               */
/******************|  DB ROW: ROLL GEOMETRY CHARACTERISTIC  |***************/
/*                  +---------------------------------------+               */
/*                                                                          */
/* DB access key:  MDB_StandNo                                              */
/*                 MDB_RollType_e                                           */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                      /*                                      */
{                                   /*                                      */
  float           lenBarrel;        /* barrel length                        */
  float           diaRollNeck;      /* roll neck diameter                   */
  float           lenRollNeck;      /* roll neck length                     */
  float           bearingDist;      /* bearing distance                     */
  float           bearingRad;       /* bearing radius                       */
                                    /*                                      */
} MDB_MdatRollGeometry;             /*                                      */
/**************************************************************************/
```

2.9.10 Mill Stretch Data RM

Max.Number of Records: 1

Record Length: 76 Byte

Unit: 1 record

Keys: - none

Record Creation Events: - none

Record Deletion Events: - none

```
/*                   +-------------------------------------+                   */
/*******************|  DB ROW: STAND STRETCH CURVE RM     |*******************/
/*                   +-------------------------------------+                   */
typedef struct                        /*                                       */
{                                     /*                                       */
  long             n;                 /* number of supporting points (<=6)    */
  float            width[6];          /* width supporting points (max 6)      */
  float            modulusMin[6];     /* mill modulus for minimum work roll   */
                                      /* and backuproll diameter (max 6)      */
  float            modulusMax[6];     /* mill modulus for maximum work roll   */
                                      /* and backuproll diameter (max 6)      */
                                      /*                                      */
} MDB_MdatStretchRM;                  /*                                      */
/*****************************************************************************/
```

2.9.11 Mill Stretch Data FM

Max.Number of Records: 6

Record Length: 1480 Byte

Unit: 1 record per stand

Keys: - Stand number

Record Creation Events: - none

Record Deletion Events: - none

```
/*                   +-------------------------------------+                   */
/*******************|  DB ROW: STAND STRETCH CURVE FM    |*******************/
/*                   +-------------------------------------+                   */
/*                                                                             */
/* DB access key:  MDB_StandNo                                                 */
/*                                                                             */
/* --------------------------------------------------------------------------- */
typedef struct                        /*                                       */
{                                     /*                                       */
  MDB_StretchFM     data              /* stretch data:                         */
                 [MDB_dNoStretchRec];/*    index  MDB_dStretchAct             */
                                      /*           MDB_dStretchMea             */
                                      /*                                       */
  MDB_StretchApprox stretchApprox;    /* approximation of mill stretch curve   */
                                      /*                                       */
} MDB_MdatStretchFM;                  /*                                       */
/*****************************************************************************/


/*              +---------------------------------------------+              */
/**************|  MILL STAND STRETCH CURVE - APPROXIMATION    |**************/
/*              +---------------------------------------------+              */
typedef struct                        /*                                       */
{                                     /*                                       */
  long              nPoly;            /* polynomial degree of mill stretch   */
                                      /* curve approximation                   */
  float             coe[4];           /* polynomial coefficients               */
  float             forceSwitch;      /* switch roll force                     */
  float             millModulus;      /* mill modulus at calibration           */
                                      /*                                       */
} MDB_StretchApprox;                  /*                                       */
/*****************************************************************************/
```

```
/*             +-------------------------------------------+             */
/**************|  MILL STAND STRETCH CURVE - HELP STRUCTURES  |**************/
/*             +-------------------------------------------+             */
typedef struct                          /*                               */
{                                       /*                               */
  float            force;               /* setpoint force                */
  float            position;            /* setpoint position             */
  float            positionOS;          /* setpoint position operator side */
  float            positionDS;          /* setpoint position drive side  */
                                        /*                               */
} MDB_Stretch;                          /*                               */
                                        /*                               */
typedef struct                          /*                               */
{                                       /*                               */
  MDB_Abstim    timeStamp;              /* time stamp                    */

  long          nSetpoint;              /* number of setpoints           */
  MDB_Stretch   mea [MDB_dMaxStretchSetp];  /* measured values           */

  float         millStrCoeff[8];        /* mill stretch coefficients [mil] */

  float         agcLinStrOffset;        /* offset lin.regr. of str.curve [in] */
  float         agcLinStrOffsetOS;      /* operator side                 */
  float         agcLinStrOffsetDS;      /* drive side                    */

  float         agcLinStrSlope;         /* slope lin.regr. of str.c.[mils/tons]*/
  float         agcLinStrSlopeOS;       /* operator side                 */
  float         agcLinStrSlopeDS;       /* drive side                    */

                                        /* std.dev. of regr. in force    */
  float         agcForceStdDev;         /* direction [tons]              */
  float         agcForceStdDevOS;       /* operator side                 */
  float         agcForceStdDevDS;       /* drive side                    */
                                        /*                               */
} MDB_StretchFM;                        /*                               */
/*****************************************************************************/
```

2.9.12 Adaptors

Max.Number of Records: 2000

Record Length: 591 Byte

Unit: 1 record per each class

Keys:
- material class
- width class
- length class
- thickness class

Record Creation Events: Shift change

Record Deletion Events: Oldest on overflow

```
/*                                                                          */
/*                       +--------------------------+                       */
/***********************|  DB ROW: MODEL ADAPTORS  |************************/
/*                       +--------------------------+                       */
/*                                                                          */
/* DB access key:  material class  (I4)                                     */
/*                 width class     (I4)                                     */
/*                 length class    (I4)                                     */
/*                 thickness class (I4)                                     */
/*                                                                          */
/* ------------------------------------------------------------------------ */
typedef struct                                  /* speed adaptors           */
{                                               /*                          */
    SLI_SlabId   slabId;                        /*                          */
    SLI_SlabId   slabIdCalc;                    /*                          */
    float        speedSetpoint[MDB_dNoStand]; /*                          */
    float        speedTot     [MDB_dNoStand]; /*                          */
    float        speedConf    [MDB_dNoStand]; /*                          */
    float        speedDevPure [MDB_dNoStand]; /*                          */
    float        speedDev     [MDB_dNoStand]; /*                          */
    long         stored;                        /*                          */
} MDB_SpeedAdapt;                               /*                          */

typedef struct                                  /* calibration adaptors     */
{                                               /*                          */
  float          stretchCalib;                  /* calibration of each stand */
  MDB_Abstim     calibTime;                     /* calibration time stamp   */
} MDB_CalibAdapt;                               /*                          */
```

```
typedef struct                                  /* Structure of DB record     */
{                                               /*                            */
  MDB_Grade      steelgrade;                    /* steel grade                */
  long           nRolled;                       /* number of materials        */
  MDB_Abstim     timRolled;                     /* time stamp last material   */
  SLI_SlabId     slabId;                        /* ID of last rolled          */
  MDB_SpeedAdapt act;                           /* speed adaptors actual      */
  MDB_SpeedAdapt prv;                           /* speed adaptors prev.mat.   */
  MDB_CalibAdapt calibAda[MDB_dNoStand];        /* calibration of each stand  */
                                                /* -------------------------- */
                                                /* stretch adaptors           */
  float          stretchAdaPrv[MDB_dNoStand]; /* previous material          */
  float          stretchAda   [MDB_dNoStand]; /* actual material            */
  long           nStretchAda;                   /* number of adaptions        */
                                                /* -------------------------- */
                                                /* thickness adaptors:        */
  float          thickAdaPrv;                   /* previous material          */
  float          thickAda;                      /* actual material            */
  long           nThickAda;                     /* number of adaptions        */
                                                /* -------------------------- */
                                                /* time adaptors:             */
  float          timeAdaPrv;                    /* previous material          */
  float          timeAda;                       /* actual material            */
  long           nTimeAda;                      /* number of adaptions        */
                                                /* -------------------------- */
                                                /* gauge adaptors:            */
  float          gaugeAdaPrv[MDB_dNoStand];     /* previous material          */
  float          gaugeAda   [MDB_dNoStand];     /* actual material            */
  long           nGaugeAda;                     /* number of adaptions        */
                                                /* -------------------------- */
  long           lSpare[MDB_dNoStand];          /* spare                      */
  float          fSpare[MDB_dNoStand];          /* rolled gauges of previous  */
                                                /* 6 materials                */
                                                /*                            */
} MDB_MdatAdaptor;                              /*                            */
/*****************************************************************************/
```

2.10 Roll Inventory Data

2.10.1 Available Rolls

Max.Number of Records: 300

Record Length: 20 Byte

Unit: 1 record per stand, roll type, position and roll

Keys:
- Stand Type
- Roll Type
- Position Type
- Roll ID

Record Creation Events:
- roll data transmission
- manual input

Record Deletion Events:
- roll change

```
/*                  +--------------------------------------+                  */
/******************|  DB ROW: ROLL INVENTORY - RECORD R0  |******************/
/*                  +--------------------------------------+                  */
/*                                                                            */
/* DB access key:  ROI_RollId                                                 */
/*                 MDB_StandType_e                                            */
/*                 MDB_RollType_e                                             */
/*                 MDB_PositionType_e                                         */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                      /*                                        */
{                                   /* forward/backward pointers:             */
                                    /* --------------------------             */
  ROI_RollId       rollIdNxt;       /* ID of next available roll              */
  ROI_RollId       rollIdPrv;       /* ID of previous available roll          */
  long             updateFlag;      /* update flag                            */
                                    /*                                        */
} MDB_RollInvR0;                    /*                                        */
/****************************************************************************/
```

2.10.2 Roll Data

Max.Number of Records: 300

Record Length: 121 Byte

Unit: 1 record per roll

Keys: Roll ID

Record Creation Events: - roll data transmission
- manual input

Record Deletion Events: - roll change

```
/*                  +--------------------------------------+                  */
/******************|  DB ROW: ROLL INVENTORY - RECORD R1  |******************/
/*                  +--------------------------------------+                  */
/*                                                                            */
/* DB access key:  ROI_RollId                                                 */
/*                                                                            */
/* -------------------------------------------------------------------------- */
typedef struct                      /*                                        */
{                                   /* roll data:                             */
                                    /* ----------                             */
  long             standType;       /* stand type                             */
  long             rollType;        /* roll type                              */
  long             posType;         /* position type                          */
  float            diameter;        /* roll diameter                          */
  float            crown;           /* roll crown                             */
  float            taper;           /* roll taper                             */
  float            eccGrinder;      /* eccentricity grinder                   */
  float            hardness;        /* roll hardness center                   */
  float            roughness;       /* roll roughness center                  */
  float            youngsMod;       /* young's elasticity modulus             */
  float            poisRatio;       /* poission's ratio                       */
  float            lambda;          /* thermal conductivity of roll           */
  float            rho;             /* density roll                           */
  float            c;               /* specific heat roll                     */
  float            expans;          /* thermal expansion coeff. of roll       */
                                    /*                                        */
                                    /* actual data:                           */
                                    /* ------------                           */
  ROI_RollId       rollIdPrv;       /* roll id of prev.installed roll         */
  MDB_Abstim       timeIn;          /* stand-in date and time                 */
  MDB_Abstim       timeOut;         /* stand-out date and time                */
  long             codeReason;      /* code roll change reason                */
  MDB_StandNo      standNo;         /* stand number:                          */
                                    /*      -1 ... RM                         */
                                    /*   1 - 6 ... FM stand number            */
  float            tonsOnRoll;      /* tons on roll                           */
  float            footageOnRoll;   /* footage on roll                        */
  long             nCoilsRolled;    /* number of rolled coils                 */
  MDB_RollUnitCode unitCode;        /* unit code                              */
                                    /*                                        */
```

```
} MDB_RollInvR1;                    /*                                        */
/*****************************************************************************/
```

2.11 Stand Data

Max.Number of Records: 8

Record Length: 912 Byte

Unit: 1 record per stand

Keys: Stand number

Record Creation Events: none

Record Deletion Events: none

```
/*                  +--------------------------------------+                  */
/******************|      THERMAL CROWN AND WEAR           |******************/
/*                  +--------------------------------------+                  */
typedef struct                        /*                                     */
{                                     /*                                     */
  float          wear[MDB_dNoSlize]; /* wear of work roll                   */
  float          temp[MDB_dNoSlize]; /* temperature of work roll            */
  float          crown[MDB_dNoSlize];/* crown of work roll                  */
  float          crownCalib;         /* crown correction calibration w/o    */
                                     /* roll change                         */
                                     /*                                     */
} MDB_CrownData;                      /*                                     */
/*************************************************************************/

/*                           +-----------------------+                       */
/***************************|  DB ROW: STAND DATA   |***********************/
/*                           +-----------------------+                       */
/*                                                                           */
/* DB access key:  MDB_StandNo:                                              */
/*                     -1 ... RM                                             */
/*                   1 - 6 ... F1 to F6                                      */
/*                                                                           */
/* ------------------------------------------------------------------------- */
typedef struct                        /*                                     */
{                                     /*                                     */
  MDB_Deltim       maxTime;           /* max allowed time for overload       */
  float            val;               /* overload value                      */
                                     /*                                     */
} MDB_OverloadTab;                    /*                                     */
                                     /*                                     */
typedef struct                        /*                                     */
{                                     /*                                     */
  MDB_Abstim       timeStamp;         /* time of calibration                 */
  float            setpForce;         /* setpoint force center [ton]         */
  float            setpPosOS;         /* setpoint position Operator Side [in]*/
  float            setpPosDS;         /* setpoint position Drive Side [in]   */
                                     /*                                     */
} MDB_CalibData;                      /*                                     */
                                     /*                                     */
typedef struct                        /*                                     */
{                                     /* general data:                       */
                                     /* -------------                       */
```

```
  MDB_Abstim       timeStamp;        /* time stamp                          */
  float            basicSpeed;       /* basic speed                         */
  float            maxSpeed;         /* maximum speed                       */
  float            motorPower;       /* motor power                         */
  float            maxForce;         /* maximum roll force                  */
  MDB_OverloadTab  overload[5];      /* overload table                      */
  float            speedUtil;        /* speed utility                       */
  float            gearRatio;        /* gear ratio                          */
  float            myFrict;          /* friction coeff. backuproll-bearing  */
  float            angleWater;       /* angle work roll cooling             */
  long             rollCool;         /* 1 work roll cooling on              */
                                     /* 0 work roll cooling off             */
  MDB_CrownData    crownData;        /* thermal crown and wear              */
                                     /*                                     */
                                     /* roll data:                          */
                                     /* ----------                          */
  MDB_Abstim       timeRollChange;   /* date & time of last roll change     */
  ROI_RollId       rollId            /* ID's of actual installed rolls:     */
                 [MDB_dMaxRollType]  /* index 1: MDB_RollType_e  (WR or BR) */
                 [MDB_dMaxPosType];  /* index 2: MDB_PosType_e (top or bot) */
                                     /*                                     */
  MDB_CalibData    calibAct;         /* values from actual calibration      */
  MDB_CalibData    calibPrv;         /* values from previous calibration    */
                                     /*                                     */
} MDB_StandData;                     /*                                     */
/*************************************************************************/
```

3. Revision and Document Distribution List

REVISION LIST

Date	Version	Author	Description
94-Feb-28	V1.0	F.Dvo	in progress
94-Apr-25	V1.1	F.Dvo	revised
94-May-20	V2.0	F.Dvo	revised
94-Jul-22	V3.0	F.Dvo	for approval
96-Feb-28	as built	F.Dvo	as built

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