A  Clay-bonded sand

Examine lustrous carbon production

Measure active carbon in moulding sand, examine lustrous carbon producer, use material with greater lustrous carbon production; increase ignition loss in moulding sand

yes
Defect remedied

Gather and interpret data

no

Examine content of low-melting-point material

Content of low-melting-point material in moulding sand promotes adherence. Examine new sand for impurities. Reduce dust content. Add new sand if necessary.

yes
Defect remedied

Gather and interpret data

no

Examine oolitization

High degree of oolitization reduces melting point. Add new sand if necessary.

yes
Defect remedied

Gather and interpret data

no

Contact IKO

B  Moulding plant

Examine compaction

Poorly compacted sections are at risk of overheating. Achieve more even compaction.

yes
Defect remedied

no

Gather and interpret data

Contact IKO

C  Gating and pouring practice

Examine gating

Excessive quantities of metal and over-rapid pouring rates cause local overheating. Achieve better distribution of metal.

yes
Defect remedied

no

Gather and interpret data

Check pouring temperature

Excessively high temperatures promote sand adhesion. Reduce pouring temperature.

yes
Defect remedied

no

Gather and interpret data

Contact IKO
A  Moulding plant

Examine stripping process

Check moulding flask for uneven stripping (most frequent cause of defect)

Examine stripping process

Defect remedied

no

Examine prefilling

Examine moulding plant for uneven sand filling

Examine prefilling

Defect remedied

no

Examine patterns

Check mould tapers, correct if necessary

Examine patterns

Defect remedied

no

Examine compacting pressure

Examine mould hardness, reduce compacting pressure if necessary

Examine compacting pressure

Defect remedied

no

Contact IKO

B  Clay-bonded sand

Examine cluster content

Reduce clusters. Use sand aerator. Reduce fines and bentonite contents if necessary.

Examine cluster content

Defect remedied

no

Examine fines

Reduce inert, non-ignitable fines content. Increase new sand content if necessary.

Examine fines

Defect remedied

no

Examine sand temperature

Reduce sand temperature if too high. Install a sand cooler if necessary.

Examine sand temperature

Defect remedied

no

Examine moisture of used sand

Pre-wetting of used sand increases plasticity and reduces the risk of cod and edge disintegration.

Examine moisture of used sand

Defect remedied

no

Contact IKO

Contact IKO
A Clay-bonded sand

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Erosion can be expected below a critical amount of bentonite. Increase bentonite content if necessary.

At a compactability of less than 30%, the bentonite is no longer totally developed. If necessary, increase compactability.

Insufficient bonding of sand occurs with too high a proportion of inert fines.

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

Examine sand grain size

With coarse sand, individual grains can be torn from the mould, use finer sand.

Examine lustrous carbon producer

With low lustrous carbon production, the metal stream can tear away sand grains. Increase activity of lustrous carbon producer.

Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

Examine sand grain size

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Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

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High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

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With coarse sand, individual grains can be torn from the mould, use finer sand.

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Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

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With coarse sand, individual grains can be torn from the mould, use finer sand.

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High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

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With coarse sand, individual grains can be torn from the mould, use finer sand.

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Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

Examine sand grain size

With coarse sand, individual grains can be torn from the mould, use finer sand.

Examine lustrous carbon producer

With low lustrous carbon production, the metal stream can tear away sand grains. Increase activity of lustrous carbon producer.

Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

Examine sand grain size

With coarse sand, individual grains can be torn from the mould, use finer sand.

Examine lustrous carbon producer

With low lustrous carbon production, the metal stream can tear away sand grains. Increase activity of lustrous carbon producer.

Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.

Examine binder content

- yes
  - Defect remedied
  - yes
  - Defect remedied
  - no
  - no

- no
  - Examine compactability
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Examine inert, non-active fines content
  
  - yes
    - Defect remedied
    - yes
    - Defect remedied
    - no
    - no

- no
  - Contact IKO

Examine sand temperature

- yes
  - Defect remedied
  - no

Severe drying occurs at high sand temperatures. Reduce sand temperature to below 40 °C.

Examine sand grain size

With coarse sand, individual grains can be torn from the mould, use finer sand.

Examine lustrous carbon producer

With low lustrous carbon production, the metal stream can tear away sand grains. Increase activity of lustrous carbon producer.

Examine salt content of sand

High salt content in water or sand leads to deactivation of bentonite.
B Moulding plant

Examine compaction
With low compaction there is insufficient bonding, sand must be more evenly distributed. Increase pressure of plant if necessary.

yes Defect remedied
no

Gather and interpret data

Contact IKO

Erosion
Contact IKO

A Clay-bonded sand

Reduce moisture content
Adjust compactability to minimum

yes Defect remedied
no

Gather and interpret data

Examine degree of mulling
Low degree of mulling necessitates a higher water content. Water is released at an early stage when casting.

yes Defect remedied
no

Gather and interpret data

Examine proportion of inert fines
Inert fines requires a lot of water which is rapidly released on heating. Reduce inert fines content (dust, bentonite, lustrous carbon carrier).

yes Defect remedied
no

Gather and interpret data

Reduce bentonite content
Lower bentonite contents require less water. Use higher bentonite quality if necessary.

yes Defect remedied
no

Gather and interpret data

Contact IKO

C Gating and pouring practice

Examine pouring rate
With too high a pouring rate, erosion occurs at overheated points. Reduce pouring rate.

yes Defect remedied
no

Gather and interpret data

Examine quantity of inflowing metal
Excessive quantities of metal will cause overheating and erosion. Achieve better metal distribution.

yes Defect remedied
no

Gather and interpret data

Contact IKO
A  Resin-bonded sand

Examine core binder  
- Measure lustrous carbon production of the binder. Use binder with lower lustrous carbon production.

Examine sand grain size  
- Higher AFS values reduce danger of explosive penetration. Use finer sand if necessary.

Examine lustrous carbon producer  
- More active lustrous carbon producers require less water. Less material usage and coke formation.

B  Moulding plant

Examine compacting pressure  
- Reduce compacting pressure. If necessary, increase uniformity of compacting.

Examine pouring rate  
- Over-rapid pouring rate leads to explosive penetrations. Reduce pouring rate.

C  Gating and pouring practice

Examine gas removal from cores  
- Improve gas removal, core venting, coarser sand grain, core prints.

Examine core binder  
- Gather and interpret data

Examine lustrous carbon producer  
- Gather and interpret data

Examine compacting pressure  
- Gather and interpret data

Examine pouring rate  
- Gather and interpret data

Contact IKO


**B  Clay-bonded sand**

- Examine lustrous carbon production in moulding sand
  - yes: Defect remedied
  - no: Examine lustrous carbon producer
    - yes: Defect remedied
    - no: Examine gas permeability
      - yes: Defect remedied
      - no: Contact IKO

- Measure active carbon. Reduce quantity of lustrous carbon producer.
  - Gather and interpret data

**C  Moulding plant**

- Examine compaction
  - yes: Defect remedied
  - no: Contact IKO

- Reduce compaction by increasing compactability or reducing compacting pressure.
  - Gather and interpret data

**D  Gating and pouring practice**

- Examine gating
  - yes: Defect remedied
  - no: Examine pouring data
    - yes: Defect remedied
    - no: Contact IKO

- Turbulence leads to lustrous carbon inclusions. Strive for laminar pouring.
  - Gather and interpret data

- Higher pouring temperatures reduce the risk of lustrous carbon inclusions.
  - Gather and interpret data

- Use less active lustrous carbon producer if necessary. Use slower-reacting materials.
  - Gather and interpret data

- Use coarser sand if possible. Reduce fines.
  - Gather and interpret data
A Metallurgy

Examine residual magnesium content

- Defect remedied
  - yes
  - no

Examine content of subversive elements

- Defect remedied
  - yes
  - no

Adjust residual magnesium content to match gating, subversive elements, pouring temperature and casting systems.

B Gating and pouring practice

Check pouring temperature

- Defect remedied
  - yes
  - no

Reduce pouring temperature. Cool melt more rapidly.

C Resin-bonded sand

Examine sulphur content

- Defect remedied
  - yes
  - no

Gather and interpret data

Use other methods.

D Clay-bonded sand

Examine formation of oxidizing gases

- Defect remedied
  - yes
  - no

Oxygen, carbon dioxide, water vapour react with the residual magnesium content. Reduce formation of these substances.

Contact IKO
Examine sulphur content in moulding sand

- yes
  - Defect remedied
- no
  - Examine formation of hydrocarbons

- yes
  - Defect remedied
- no
  - Use low-sulphur carbon carrier.
  - Examine inflowing core sand for sulphur.

Gather and interpret data

---

Examine nitrogen content

- yes
  - Defect remedied
- no
  - Use sufficient quantities of lustrous carbon producer.
  - Increase lustrous carbon production if necessary.

Gather and interpret data

---

A Metallurgy

Check titanium content

- yes
  - Defect remedied
- no
  - Titanium bonds nitrogen; add pure titanium if necessary.
  - Increase titanium level to 0.03%.

Gather and interpret data

---

Check CE value

- yes
  - Defect remedied
- no
  - Critical CE values between 3.4 and 3.8.
  - Increase to 3.8 if necessary.

Gather and interpret data

---

Contact IKO

---
B  Resin-bonded sand

- Check nitrogen content of binder
  - yes: Defect remedied
  - no: Examine gas formation

- yes: Defect remedied
- no: Examine release of gas

- yes: Defect remedied
- no: Add iron oxide

- yes: Defect remedied
- no: Contact IKO

- Reduce or avoid nitrogen-containing binders, hardeners, admixtures.
- Gather and interpret data

C  Clay-bonded sand

- Reduce moisture content
  - yes: Defect remedied
  - no: Gather and interpret data

- Gas absorption increases due to residual moisture. Reduce quantity of bentonite and inert dust.

- yes: Defect remedied
- no: Examine nitrogen contents

- Reduce nitrogen contents by adding new sand. Use lustrous carbon producer with low nitrogen content.

- yes: Defect remedied
- no: Gather and interpret data

- More active lustrous carbon producers with low nitrogen content preferable. Quantity and release of gas/unit of time should be kept low.

- yes: Defect remedied
- no: Contact IKO
D  Gating and pouring practice

Examine gating

- Shortened flow channels prevent gas absorption. Avoid turbulence.
- Gather and interpret data

- yes
- Defect remedied
- no
- Check pouring temperature
- Faster and hotter pouring leads to improved liberation of gases.
- Gather and interpret data
- yes
- Defect remedied
- no
- Contact IKO

Examine gas formation
- Check gasification rate and quantity of lustrous carbon producers. Reduce quantities if necessary. Check bentonite content and mould moisture, reduce if necessary.
- yes
- Defect remedied
- no
- Gather and interpret data
- Contact IKO

A  Metallurgy

Examine solidification range
- Defect occurs only in metals with a wide solidification range. Reduce CE value. Remove low-melting-point components (in case of grey iron, phosphorus content).
- yes
- Defect remedied
- no
- Gather and interpret data

Examine gas contents
- Combine gases or remove by degassing
- yes
- Defect remedied
- no
- Gather and interpret data
- Contact IKO

B  Clay-bonded sand

Examine gas formation
- yes
- Defect remedied
- no
- Gather and interpret data
- Contact IKO
Apply facing sand materials

<table>
<thead>
<tr>
<th>yes</th>
<th>Defect remedied</th>
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<tbody>
<tr>
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Apply chrome ore sand or other materials with good heat conductivity at critical points.

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Examine mould stability

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Examine radii of moulds

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C Resin-bonded sand

Examine gas formation

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Examine inert content in dust

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Excessive dust contents bind water and reduce gas permeability. Reduce inert dust contents if necessary.

D Moulding plant

Apply facing sand materials

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Use materials with high heat conductivity at critical points.

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Swelling and expansion of mould increase risk of defect. Compact mould evenly. Reduce compactability. Reduce bentonite content.

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Increase edge radii. Reduces the risk of gas transfer points.

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Examine gas formation

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Check gasification rate and quantity of binder. Reduce quantity, use slow-reacting binder.

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Examine inert content in dust

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**A  Clay-bonded sand**

- Check fluoride content in moulding sand
  - yes: Defect remedied
  - no: Check water content
    - yes: Defect remedied
    - no: Examine feeder material in moulding sand
      - yes: Defect remedied
      - no: Contact IKO

- Use more new sand where content is too high
  - yes: Gather and interpret data
  - no: Examine need for feeder consumption

**B  Metallurgy**

- Examine Mg content
  - yes: Defect remedied
  - no: Contact IKO

- Keep Mg content in melt as low as possible.
  - yes: Gather and interpret data
  - no: Examine Mg content

**C  Gating and pouring practice**

- Examine need for feeder consumption
  - yes: Defect remedied
  - no: Check pouring temperature

- Use as few feeders as possible. Use insulation feeders if possible.
  - yes: Gather and interpret data
  - no: Examine need for feeder consumption

- Reduce pouring temperature
  - yes: Defect remedied
  - no: Check pouring temperature

- Contact IKO
### A  Resin-bonded sand

1. **Examine core venting**
   - yes: Defect remedied
   - no: Examine binder

2. **Examine binder**
   - yes: Defect remedied
   - no: Examine moisture content

3. **Examine moisture content**
   - yes: Defect remedied
   - no: Check gas permeability of cores

4. **Check gas permeability of cores**
   - yes: Defect remedied
   - no: Examine binder

   **Use coarser core sands.**
   - yes: Defect remedied
   - no: Contact IKO

### B  Clay-bonded sand

1. **Check sand moisture**
   - yes: Defect remedied
   - no: Gather and interpret data

2. **Check gas permeability**
   - yes: Defect remedied
   - no: Gather and interpret data

3. **Check sand temperature**
   - yes: Defect remedied
   - no: Check sand moisture

4. **Examine bentonite**
   - yes: Defect remedied
   - no: Gather and interpret data

   **Check development rate of bentonite, inert fines etc.**
   - yes: Defect remedied
   - no: Contact IKO

   **Use high quality bentonite.**
A Clay-bonded sand

- Check sand grain size
  - Penetration occurs above a critical pore size.
  - Use finer sand if necessary.

- Gather and interpret data
  - Defect remedied

C Moulding plant

- Examine compaction
  - Determine mould hardness, reduce compacting pressure.

- Gather and interpret data
  - Defect remedied

D Gating and pouring practice

- Check pouring temperature
  - Liquidus temperature should be noticeably exceeded.

- Gather and interpret data
  - Defect remedied

- Check gating
  - Avoid turbulence, optimize pouring times.
  - Separate slags; optimize pouring pressure.

- Gather and interpret data
  - Defect remedied
**B  Resin-bonded sand**

- **Check sand grain size**
  - **Penetration occurs above a critical pore size.**
  - Use finer sand if necessary.
  - Defect remedied
  - Gather and interpret data
  - **no**
    - **Apply coatings**
    - Seal pores by applying coatings.
    - Use thicker applications if required.
    - Defect remedied
    - Gather and interpret data
    - **no**
      - **Examine binding agent**
      - Highly viscous binding agents result in uncompacted core sections; use binder with low viscosity.
      - Examine lustrous carbon producers.
      - Binders with high lustrous carbon production preferable.
      - Defect remedied
      - Gather and interpret data
      - **no**
        - **Contact IKO**

**C  Moulding plant**

- **Check compaction**
  - Make compaction more uniform. Examine deeper codes.
  - Ensure even prefilling.
  - Defect remedied
  - Gather and interpret data
  - **no**
    - **Check gating**
    - Excessive quantities of inflowing metal cause overheating.
    - Achieve more even and better metal distribution.
    - Check pattern plate arrangement.
    - Defect remedied
    - Gather and interpret data
    - **no**
      - **Check pouring temperature**
      - Reduce pouring temperature if necessary
      - Defect remedied
      - Gather and interpret data
      - **no**
        - **Contact IKO**

**D  Gating and pouring practice**

- **Check pouring temperature**
  - Excessive quantities of inflowing metal cause overheating.
  - Achieve more even and better metal distribution.
  - Check pattern plate arrangement.
  - Defect remedied
  - Gather and interpret data
  - **no**
    - **Check gating**
    - Defect remedied
    - Gather and interpret data
    - **no**
      - **Contact IKO**

**Apply coatings**
- Seal pores by applying coatings.
- Use thicker applications if required.
- Defect remedied
- Gather and interpret data
- **no**
  - **Examine binding agent**
  - Highly viscous binding agents result in uncompacted core sections; use binder with low viscosity.
  - Examine lustrous carbon producers.
  - Binders with high lustrous carbon production preferable.
  - Defect remedied
  - Gather and interpret data
  - **no**
    - **Contact IKO**
A Metallurgy (ferrous metals)

- Check nitrogen content of melt
  - Nitrogen content too high due to charge make-up. Reduce steel content for grey and SG cast irons.
  - Gather and interpret data
    - yes: Defect remedied
    - no: Check change materials for oxides and hydroxides
      - Use oxide-free and rust-free materials. In case of return scrap, watch for adhering feeders.
      - Gather and interpret data
        - yes: Defect remedied
        - no: Check aluminium content
          - Reduce aluminium content; this reduces the reaction of water vapour with residual aluminium.
          - Gather and interpret data
            - yes: Defect remedied
            - no: Check titanium content
              - The same applies as with aluminium. Titanium is used in melt beforehand to avoid pinholes. Hydrogen absorption increases in circulation.
              - Gather and interpret data
                - yes: Defect remedied
                - no: Contact IKO

- Check manganese content
  - Manganese forms MnS slags with sulphides in the melt, which play a part in the formation of CO micro-holes. Reducing Mn content can be helpful.
  - Gather and interpret data
    - yes: Defect remedied
    - no: Contact IKO

B Clay-bonded sand

- Check nitrogen content
  - High nitrogen contents can stem from lustrous carbon producers and, in particular, from core binders. Reduce proportion by adding new sand if necessary.
  - Gather and interpret data
    - yes: Defect remedied
    - no: Check moisture
      - Reducing water content results in lower quantities of water vapour and hydrogen.
      - Gather and interpret data
        - yes: Defect remedied
        - no: Check lustrous carbon carriers
          - Increased lustrous carbon production in moulding sand causes a reducing atmosphere in mould cavity and thus diminished likelihood of initial CO micro-holes.
          - Gather and interpret data
            - yes: Defect remedied
            - no: Contact IKO
        - yes: Defect remedied
        - no: Gather and interpret data
          - yes: Defect remedied
          - no: Contact IKO
C Resin-bonded sand

Examine nitrogen in core

Urea-containing resins release nitrogen. Binders with low urea content reduce nitrogen pick-up in the melt and have a generally positive effect.

yes
Defect remedied
Gather and interpret data
no
Add iron oxide
Iron oxide admixtures prevent nitrogen absorption in the melt and have a generally positive effect.

yes
Defect remedied
Gather and interpret data
no
Contact IKO

D Gating and pouring practice

Examine gating
Shortened flow channels reduce gas absorption and counteract the risk of pinholes.

yes
Defect remedied
Gather and interpret data
no
Examine for presence of slag
Slag-free pouring reduces the risk of CO micro-holes into which \( N_2 \) and \( H_2 \) diffuse.

yes
Defect remedied
Gather and interpret data
no
Contact IKO

A Clay-bonded sand

Examine sand grain size
Use finer sand grain if necessary.

yes
Defect remedied
Gather and interpret data
no
Examine lustrous carbon production
Measure active carbon. Increase additions of carbon carrier.

yes
Defect remedied
Gather and interpret data
no
Examine lustrous carbon producer
Use carbon carrier with higher lustrous carbon producing capacity.

yes
Defect remedied
Gather and interpret data
no
Examine fines content
Increase fines if necessary. Use lustrous carbon carrier with higher coke producing capacity.

yes
Defect remedied
Gather and interpret data
no
Contact IKO
B Moulding plant

- Examine compaction
  - yes: Defect remedied
  - no: Examine mould surface
    - yes: Defect remedied
    - no: Contact IKO

- Gating and pouring practice
  - Check pouring temperature
    - yes: Defect remedied
    - no: Contact IKO

A Moulding plant

- Examine mould for pressure points
  - yes: Defect remedied
  - no: Gather and interpret data

- Separate flasks after assembling and perform visual inspection. Blow out mould flasks, fit pressure pads if necessary.
  - yes: Defect remedied
  - no: Gather and interpret data

- Inspect patterns for cracks and smoothness. Increase tapers and radii of patterns if necessary. Heat pattern plates; use release agent.
  - yes: Defect remedied
  - no: Gather and interpret data

- Examine mould stripping process
  - yes: Defect remedied
  - no: Gather and interpret data

- Examine core setting
  - yes: Defect remedied
  - no: Gather and interpret data

  Check for edge crumbling when coring up and for core misalignment. Employ automatic core insertion.

- Contact IKO
B Clay-bonded sand

Examine compactability

- Increase compactability. High compactability reduces the risk of over-compaction and increases plasticity.

- yes Defect remedied
  - no Gather and interpret data

Examine bentonite content

- Increase bentonite content, increase mixing times. Try to achieve better bentonite development. Improve pre-wetting.

- yes Defect remedied
  - no Gather and interpret data

Examine inert dust content

- Limit proportion of dead-burnt inert fines to 2 – 2.5 % with 10 % activated clay. Restrict by adding new sand or bentonite if necessary.

- yes Defect remedied
  - no Gather and interpret data

Contact IKO

C Resin-bonded sand

Examine core strength

- Where core breakage occurs, increase binder content as appropriate. Improve compaction.

- yes Defect remedied
  - no Gather and interpret data

Contact IKO
### D Gating and pouring practice

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Decision</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine gating</td>
<td>Improve distribution of gates if possible; avoid turbulence.</td>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Examine pouring rate</td>
<td>Reduce pouring rate if necessary.</td>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Contact IKO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### A Metallurgy

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Decision</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine melt</td>
<td>Reduce oxygen-affinitive elements (Al, Mg, Mn). Reduce sulphur content if necessary.</td>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Examine inoculation</td>
<td>Examine dissolution capacity of inoculant. Avoid mould inoculation if necessary. Re-specify type and grain of inoculant.</td>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Examine ladle lining</td>
<td>Examine reaction of lining with the melt, particularly at metal/atmosphere interface. Use refractory mixtures. If necessary, improve drying of ladle.</td>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Avoid inflow of slag into ladle. Retain slag when pouring. Use teapot spout ladle; use slag-forming admixture if necessary. Clean ladle after pouring.</td>
<td>yes</td>
<td>Defect remedied</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td></td>
<td></td>
<td>Gather and interpret data</td>
</tr>
<tr>
<td>Contact IKO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B  Gating and pouring practice

Examine pouring conditions

Raise temperature. Shorten pouring time.

Gather and interpret data

yes

Defect remedied

no

Examine gating

Keep pouring basin full, avoid turbulence. Use a dross filter, use strainer core.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

Examine bentonite content

Increase bentonite content if necessary. Improve development of bentonite.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

Examine lustrous carbon producer

Use material that has a higher lustrous carbon production. Increase quantity if necessary.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

Examine gating

Keep pouring basin full, avoid turbulence. Use a dross filter, use strainer core.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

Examine inert dust content

Do not allow inert fines content to rise above 2 % with 10 % activated clay. Add new sand.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

Contact IKO

C  Clay-bonded sand
A  Clay-bonded sand

- Examine bentonite content
  - yes: Defect remedied
  - no: Examine dust content
    - yes: Defect remedied
    - no: Examine sand grain size
      - yes: Defect remedied
      - no: Examine degree of mulling
        - yes: Defect remedied
        - no: Contact IKO

- Examine degree of chamottization
  - yes: Defect remedied
  - no: Gather and interpret data

- Examine water quality
  - yes: Defect remedied
  - no: Gather and interpret data

- Examine compaction
  - yes: Defect remedied
  - no: Gather and interpret data

- Examine bentonite content
  - Measure wet tensile strength. If necessary, increase bentonite content or change its quality.

- Examine dust content
  - Silica-containing inert fines increase compressive stress; improve sand de-dusting. Use bentonite with higher montmorillonite content.

- Examine sand grain size
  - A high fines content increases compressive stress. Choose wider or coarser grain size distribution.

- Examine degree of mulling
  - With low degree of mulling, pre-wetting is beneficial. Increase mixing time, carry out re-activation if necessary.

- Examine water quality
  - Poor water quality leads to over-salting. Carry out partial desalination if necessary.

B  Moulding plant

- Examine compaction
  - Excessive compaction results in compressive stress. Reduce compacting pressure, endeavour to achieve more uniform compaction. Increase compactability if necessary.

- Examine bentonite content
  - yes: Defect remedied
  - no: Contact IKO

- Examine dust content
  - yes: Defect remedied
  - no: Contact IKO

- Examine sand grain size
  - yes: Defect remedied
  - no: Contact IKO

- Examine degree of mulling
  - yes: Defect remedied
  - no: Contact IKO
C Gating and pouring practice

Examine gating system

Yes
Defect remedied

no

Check pouring times

Local overheating due to over-rapid metal flow promotes scab formation. Improve inflow of metal.

Yes
Defect remedied

no

Strive for faster pouring and shorter radiation heat exposure times.

Gather and interpret data

Examine compaction

Measure mould hardness. Improve sand distribution when filling. Increase compacting pressure if necessary.

Examine patterns.

Gather and interpret data

A Moulding plant

Examine compaction

Yes
Defect remedied

no

Contact IKO

B Clay-bonded sand

Check compactability

Reduce compactability. Moulds become firmer, compaction more uniform.

yes
Defect remedied

no

Use products containing graphite. Compaction of sand becomes more uniform.

yes
Defect remedied

no

Contact IKO

Gather and interpret data
C  Resin-bonded sand

Examine cores

- yes: Defect remedied
- no: Gather and interpret data
- no: Contact IKO

Examine cores insufficiently compacted, improve compaction. Improve hardening of cores.

D  Metallurgy

Examine graphitization pressure

- yes: Defect remedied
- no: Gather and interpret data
- no: Contact IKO

For grey cast iron, expansion pressure possible due to graphite formation in melt. Increase phosphorus content.

A  Clay-bonded sand

Examine compactability

- yes: Defect remedied
- no: Gather and interpret data

- yes: Defect remedied
- no: Gather and interpret data
- yes: Defect remedied
- no: Gather and interpret data
- yes: Defect remedied
- no: Gather and interpret data
- yes: Defect remedied
- no: Gather and interpret data

Cores insufficiently compacted, improve compaction. Improve hardening of cores.

Examine sand grain size

- yes: Defect remedied
- no: Gather and interpret data

Coarse sands promote metal penetration. Use finer new sand; use finer core sand if necessary.

Examine heat resistance of moulding sand

- yes: Defect remedied
- no: Gather and interpret data

Low-melting admixtures, impurities and a higher degree of oolitization all promote penetration due to chemical reaction. Add greater quantities of new good silica sand.

Examine lustrous carbon production

- yes: Defect remedied
- no: Gather and interpret data

Lustrous carbon separates the melt from the moulding sand. Increase quantity of lustrous carbon producer. Use lustrous carbon producer with greater coke formation.

Contact IKO
B  Moulding plant

Examine compaction

Measure mould hardness. Improve sand distribution before compacting. Increase compacting pressure if necessary. Examine pattern design.

Gather and interpret data

yes

Defect remedied

no

Contact IKO

C  Resin-bonded sand

Examine cores

Improve compaction of cores. Use finer core sand if necessary.

Gather and interpret data

yes

Defect remedied

no

Coat cores

Coat cores at critical points (overheated sections and under-compacted areas).

Gather and interpret data

yes

Defect remedied

no

Contact IKO

D  Gating and pouring practice

Check pouring temperature

Reduce pouring temperature if necessary

Gather and interpret data

yes

Defect remedied

no

Examine gating system

Improve distribution of inflowing quantities of metal. Avoid overheated areas. Avoid excessive metallostatic pressure.

Gather and interpret data

yes

Defect remedied

no

Contact IKO
### A Clay-bonded sand

<table>
<thead>
<tr>
<th>Decision</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate gas formation</td>
<td>Reduce moisture. Reduce quantity of bentonite if necessary. Examine lustrous carbon carrier, reduce quantity if necessary. Use more active materials.</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Investigate gas permeability</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Examine patterns</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Contact IKO</td>
</tr>
</tbody>
</table>

### B Moulding plant

<table>
<thead>
<tr>
<th>Decision</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine patterns</td>
<td>Increase radii on edges of patterns.</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Examine patterns</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Contact IKO</td>
</tr>
</tbody>
</table>

### C Resin-bonded sand

<table>
<thead>
<tr>
<th>Decision</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine core sand</td>
<td>Use coarser core sand and increase gas permeability.</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Examine core binder</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Reduce quantity of binder. Use binders which release gas more slowly.</td>
</tr>
<tr>
<td>yes</td>
<td>Contact IKO</td>
</tr>
</tbody>
</table>

### D Gating and pouring practice

<table>
<thead>
<tr>
<th>Decision</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check pouring temperature</td>
<td>Reduce pouring temperature if necessary.</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Examine gating system</td>
</tr>
<tr>
<td>yes</td>
<td>Defect remedied</td>
</tr>
<tr>
<td>no</td>
<td>Improve secondary feeding of critical points.</td>
</tr>
<tr>
<td>yes</td>
<td>Contact IKO</td>
</tr>
</tbody>
</table>